# CAMBRIAN VOLCANISM AND MINERALIZATION, SOUTH-WEST TASMANIA

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Appendices and Plates

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* $Fe_2O_3$ = Total iron expressed as $Fe_2O_3$
※ S = Total sulphur expressed as S
L.O.I. = Loss on ignition

TABLE I. Analyses of rocks from the Jukes-Darwin area - Darwin Granite.

| Number | 41174 | 41372 | 41373 | 41374 | 41375 |
|---|---|---|---|---|---|
| $SiO_2$ | 73.92 | 76.80 | 77.63 | 77.62 | 71.90 |
| $Al_2O_3$ | 13.59 | 12.67 | 13.07 | 13.78 | 9.63 |
| *$Fe_2O_3$ | 1.62 | 0.74 | 0.68 | 0.60 | 13.35 |
| MgO | 0.34 | 0.08 | 0.26 | 0.09 | 1.26 |
| CaO | 0.17 | 0.17 | 0.08 | 0.55 | 0.15 |
| $Na_2O$ | 2.68 | 2.94 | 2.93 | 4.01 | 0.06 |
| $K_2O$ | 5.36 | 5.20 | 2.59 | 1.08 | 2.04 |
| $TiO_2$ | 0.18 | 0.06 | 0.12 | 0.19 | 0.21 |
| $P_2O_5$ | 0.06 | 0.02 | 0.00 | 0.00 | 0.13 |
| MnO | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 |
| BaO | 0.10 | 0.02 | 0.08 | 0.01 | 0.05 |
| L.O.I. | 1.17 | 0.91 | 1.46 | 1.68 | 2.20 |
| TOTAL | 99.19 | 99.61 | 98.90 | 99.61 | 101.22 |
| *S | 0.12 | 0.02 | 0.10 | 0.11 | 0.09 |
| | | | | | |
| Rb | 185 | 215 | 115 | 47 | 105 |
| Ba | 896 | 234 | 748 | 100 | 468 |
| Sr | 130 | 56 | 96 | 183 | 4 |
| La | 103 | 43 | 37 | 33 | 48 |
| Ce | 0 | 0 | 0 | 0 | 130 |
| Y | 25 | 10 | 10 | 3 | 15 |
| Th | 12 | 53 | 43 | 23 | 24 |
| Zr | 138 | 65 | 90 | 156 | 46 |
| Nb | 12 | 20 | 17 | 19 | 16 |
| Ti | 1078 | 470 | 720 | 1140 | 1260 |
| Ni | 1 | 2 | 0 | 0 | 0 |
| Sc | 1 | 2 | 0 | 0 | 8 |
| V | 27 | 26 | 17 | 24 | 156 |
| Cr | 20 | 30 | 22 | 23 | 0 |
| Li | 40 | 5 | 2 | 14 | 14 |
| Ga | 19 | 20 | 13 | 10 | 17 |
| Ge | 4 | 6 | 0 | 0 | 1 |
| Cu | 9 | 13 | 13 | 24 | 0 |
| Pb | 23 | 8 | 25 | 43 | 5 |
| Zn | 41 | 18 | 22 | 52 | 167 |

TABLE II. Analyses of rocks from the Jukes-Darwin area - Intercolonial Volcanics.

| Number | 41376 | 41092 | 41134 | 41142 | 41378 |
|---|---|---|---|---|---|
| $SiO_2$ | 67.82 | 75.18 | 72.43 | 73.02 | 73.89 |
| $Al_2O_3$ | 14.80 | 12.31 | 13.50 | 10.96 | 14.07 |
| *$Fe_2O_3$ | 3.26 | 2.87 | 2.76 | 2.05 | 2.95 |
| MgO | 1.20 | 0.36 | 0.81 | 0.84 | 0.37 |
| CaO | 0.03 | 0.00 | 0.51 | 1.21 | 0.00 |
| $Na_2O$ | 0.21 | 2.59 | 3.19 | 0.32 | 1.07 |
| $K_2O$ | 9.15 | 5.19 | 5.13 | 8.74 | 5.54 |
| $TiO_2$ | 0.39 | 0.24 | 0.33 | 0.09 | 0.16 |
| $P_2O_5$ | 0.05 | 0.03 | 0.05 | 0.02 | 0.04 |
| MnO | 0.00 | 0.00 | 0.01 | 0.12 | 0.00 |
| BaO | 0.23 | 0.14 | 0.19 | 0.28 | 0.05 |
| L.O.I. | 1.62 | 0.85 | 1.20 | 2.24 | 1.96 |
| TOTAL | 98.76 | 99.76 | 100.11 | 99.89 | 100.10 |
| ※S | 0.14 | 0.15 | 0.01 | 0.13 | 0.12 |
| | | | | | |
| Rb | 475 | 162 | 144 | 214 | 166 |
| Ba | 2060 | 1250 | 1700 | 2500 | 516 |
| Sr | 50 | 50 | 76 | 113 | 10 |
| La | 66 | 82 | 36 | 47 | 87 |
| Ce | 70 | 100 | 50 | 140 | 140 |
| Y | 58 | 46 | 33 | 50 | 35 |
| Th | 26 | 19 | 20 | 31 | 41 |
| Zr | 320 | 253 | 298 | 110 | 197 |
| Nb | 21 | 27 | 15 | 24 | 21 |
| Ti | 2336 | 1440 | 1980 | 510 | 960 |
| Ni | 9 | 1 | 10 | 12 | 3 |
| Sc | 13 | 10 | 7 | 3 | 1 |
| V | 15 | 20 | 20 | 18 | 20 |
| Cr | 20 | 16 | 20 | 28 | 16 |
| Li | 11 | 5 | 11 | 5 | 0 |
| Ga | 21 | 17 | 19 | 13 | 17 |
| Ge | 2 | 2 | 0 | 4 | 0 |
| Cu | 0 | 2 | 0 | 6 | 0 |
| Pb | 10 | 10 | 20 | 1 | 0 |
| Zn | 47 | 56 | 59 | 22 | 3 |

TABLE II continued. Analyses of rocks from the Jukes-Darwin area - Intercolonial Volcanics.

| Number | 41383 | 41384 | 41233 | 41385 | 41391 | 41263 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 72.19 | 76.96 | 77.30 | 72.35 | 70.40 | 75.03 |
| $Al_2O_3$ | 12.29 | 12.31 | 11.94 | 13.25 | 12.58 | 12.97 |
| *$Fe_2O_3$ | 2.95 | 2.73 | 2.59 | 4.63 | 6.15 | 2.73 |
| MgO | 0.43 | 0.56 | 0.64 | 0.68 | 0.41 | 0.30 |
| CaO | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 | 0.10 |
| $Na_2O$ | 0.43 | 0.04 | 0.41 | 0.28 | 0.33 | 0.11 |
| $K_2O$ | 7.03 | 4.95 | 4.44 | 6.62 | 7.63 | 7.05 |
| $TiO_2$ | 0.26 | 0.25 | 0.23 | 0.31 | 0.29 | 0.29 |
| $P_2O_5$ | 0.02 | 0.01 | 0.02 | 0.03 | 0.06 | 0.02 |
| MnO | 0.00 | 0.00 | 0.02 | 0.03 | 0.11 | 0.00 |
| BaO | 2.03 | 0.36 | 0.24 | 0.27 | 0.28 | 0.10 |
| L.O.I. | 1.66 | 1.96 | 2.21 | 1.69 | 1.56 | 1.32 |
| TOTAL | 99.29 | 100.13 | 100.06 | 100.14 | 99.84 | 100.02 |
| *S | 0.43 | 0.18 | 0.00 | 0.08 | 0.17 | 0.00 |
| Rb | 216 | 230 | 223 | 242 | 172 | 238 |
| Ba | 18180 | 3220 | 2150 | 2420 | 2530 | 900 |
| Sr | 397 | 20 | 21 | 40 | 69 | 84 |
| La | 23 | 20 | 50 | 27 | 38 | 21 |
| Ce | 500 | 100 | 90 | 80 | 100 | 60 |
| Y | 43 | 41 | 43 | 49 | 38 | 42 |
| Th | 25 | 20 | 35 | 23 | 28 | 33 |
| Zr | 264 | 280 | 334 | 300 | 233 | 272 |
| Nb | 12 | 9 | 5 | 6 | 8 | 17 |
| Ti | 1560 | 1500 | 1380 | 1860 | 1740 | 1740 |
| Ni | 11 | 6 | 10 | 14 | 1 | 6 |
| Sc | 9 | 9 | 10 | 8 | 6 | 7 |
| V | 7 | 14 | 16 | 12 | 38 | 20 |
| Cr | 24 | 18 | 25 | 22 | 32 | 23 |
| Li | 12 | 5 | 8 | 11 | 5 | 14 |
| Ga | 15 | 20 | 14 | 19 | 26 | 16 |
| Ge | 3 | 5 | 3 | 3 | 4 | 5 |
| Cu | 8 | 0 | 12 | 6 | 122 | 0 |
| Pb | 0 | 8 | 0 | 0 | 15 | 13 |
| Zn | 15 | 22 | 14 | 48 | 73 | 0 |

TABLE III. Analyses of rocks from the Jukes-Darwin area - Intercolonial Volcanics, mineralised and associated.

| Number | 41093 | 41117 | 41377 | 41381 | 41382 |
|---|---|---|---|---|---|
| $SiO_2$ | 52.35 | 62.92 | 65.83 | 71.70 | 58.45 |
| $Al_2O_3$ | 11.54 | 9.90 | 14.52 | 14.71 | 10.34 |
| *$Fe_2O_3$ | 25.69 | 17.63 | 7.33 | 8.03 | 23.08 |
| MgO | 1.33 | 0.74 | 0.87 | 0.57 | 0.95 |
| CaO | 0.00 | 0.05 | 0.19 | 0.05 | 0.05 |
| $Na_2O$ | 0.15 | 0.18 | 1.00 | 0.07 | 0.28 |
| $K_2O$ | 7.69 | 6.21 | 5.21 | 3.06 | 0.22 |
| $TiO_2$ | 0.31 | 0.17 | 0.69 | 0.19 | 0.20 |
| $P_2O_5$ | 0.05 | 0.08 | 0.10 | 0.02 | 0.05 |
| MnO | 0.00 | 0.00 | 0.01 | 0.14 | 0.31 |
| BaO | 0.33 | 0.28 | 0.12 | 0.05 | 0.01 |
| L.O.I. | 0.55 | 2.13 | 4.03 | 2.36 | 3.31 |
| TOTAL | 99.99 | 100.29 | 99.90 | 100.95 | 100.38 † |
| *S | 0.18 | 2.30 | 2.75 | 0.03 | 0.98 |
| Rb | 195 | 125 | 202 | 133 | 7 |
| Ba | 2960 | 2510 | 1070 | 462 | 82 |
| Sr | 45 | 44 | 82 | 11 | 6 |
| La | 104 | 162 | 25 | 30 | 0 |
| Ce | 350 | 400 | 20 | 70 | 100 |
| Y | 33 | 196 | 37 | 42 | 46 |
| Th | 30 | 25 | 5 | 16 | 9 |
| Zr | 200 | 74 | 215 | 220 | 160 |
| Nb | 18 | 31 | 16 | 16 | 13 |
| Ti | 1860 | 1020 | 4130 | 1140 | 1200 |
| Ni | 4 | 14 | 25 | 1 | 0 |
| Sc | 7 | 1 | 15 | 6 | 5 |
| V | 63 | 25 | 72 | 23 | 26 |
| Cr | 0 | 0 | 16 | 6 | 0 |
| Li | 17 | 11 | 17 | 5 | 2 |
| Ga | 34 | 22 | 19 | 18 | 22 |
| Ge | 8 | 4 | 0 | 0 | 0 |
| Cu | 62 | 143 | 566 | 15 | 17175 |
| Pb | 15 | 8 | 47 | 0 | 26 |
| Zn | 118 | 115 | 39 | 87 | 248 |

† includes 2.15% CuO

TABLE III continued. Analyses of rocks from the Jukes-Darwin area - Intercolonial Volcanics, mineralised and associated.

| Number | 41388 | 41389 | 41390 | 41319 | 41324 |
|---|---|---|---|---|---|
| $SiO_2$ | 73.36 | 55.13 | 53.88 | 67.72 | 70.83 |
| $Al_2O_3$ | 12.86 | 11.60 | 9.02 | 9.98 | 12.20 |
| *$Fe_2O_3$ | 5.59 | 24.34 | 25.66 | 11.92 | 6.48 |
| MgO | 0.82 | 2.32 | 2.04 | 0.28 | 0.86 |
| CaO | 0.05 | 0.20 | 0.11 | 0.01 | 0.15 |
| $Na_2O$ | 0.55 | 0.23 | 0.01 | 0.07 | 0.04 |
| $K_2O$ | 5.54 | 0.76 | 0.22 | 3.26 | 3.97 |
| $TiO_2$ | 0.22 | 0.51 | 0.23 | 0.40 | 0.47 |
| $P_2O_5$ | 0.02 | 0.10 | 0.06 | 0.01 | 0.10 |
| MnO | 0.01 | 0.12 | 0.13 | 0.00 | 0.14 |
| BaO | 0.15 | 0.03 | 0.01 | 0.07 | 0.15 |
| L.O.I. | 1.85 | 4.20 | 4.55 | 7.21 | 4.55 |
| TOTAL | 101.02 | 99.83 † | 99.69 x | 100.93 | 99.94 |
| *S | 0.00 | 0.70 | 3.10 | 6.99 | 1.27 |
| | | | | | |
| Rb | 205 | 22 | 10 | 150 | 176 |
| Ba | 1340 | 283 | 80 | 580 | 1340 |
| Sr | 32 | 7 | 8 | 12 | 14 |
| La | 44 | 0 | 0 | 18 | 54 |
| Ce | 50 | 100 | 100 | 80 | 80 |
| Y | 44 | 173 | 40 | 38 | 45 |
| Th | 19 | 15 | 21 | 13 | 18 |
| Zr | 278 | 267 | 96 | 102 | 177 |
| Nb | 10 | 20 | 3 | 0 | 7 |
| Ti | 1320 | 3055 | 1380 | 2400 | 2815 |
| Ni | 11 | 13 | 5 | 9 | 11 |
| Sc | 6 | 16 | 6 | 7 | 10 |
| V | 15 | 93 | 45 | 49 | 42 |
| Cr | 8 | 0 | 0 | 14 | 8 |
| Li | 23 | 35 | 35 | 3 | 23 |
| Ga | 17 | 41 | 30 | 13 | 24 |
| Ge | 1 | 5 | 4 | 3 | 2 |
| Cu | 80 | 2114 | 30120 | 45 | 33 |
| Pb | 26 | 2 | 38 | 7 | 4 |
| Zn | 34 | 225 | 205 | 14 | 84 |

† includes 0.29% CuO

x includes 3.77% CuO

TABLE IV. Analyses of rocks from the Jukes-Darwin area - Andrew Volcanics.

| Number | 41151 | 41379 | 41380 | 41239 | 41386 | 41387 | 41392 | 41247 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 70.42 | 70.66 | 70.64 | 69.32 | 70.56 | 68.93 | 71.00 | 74.15 |
| $Al_2O_3$ | 14.52 | 15.55 | 16.27 | 16.18 | 15.98 | 15.43 | 15.02 | 14.39 |
| *$Fe_2O_3$ | 6.72 | 3.64 | 2.99 | 3.08 | 2.92 | 3.15 | 4.39 | 3.09 |
| MgO | 0.45 | 0.83 | 0.80 | 0.46 | 0.83 | 1.52 | 1.03 | 0.55 |
| CaO | 2.61 | 0.02 | 0.09 | 0.00 | 0.00 | 0.00 | 0.15 | 0.02 |
| $Na_2O$ | 0.21 | 1.91 | 0.80 | 1.58 | 0.63 | 0.91 | 1.78 | 0.55 |
| $K_2O$ | 1.73 | 5.15 | 4.90 | 6.06 | 4.64 | 6.73 | 4.27 | 4.18 |
| $TiO_2$ | 0.39 | 0.41 | 0.47 | 0.48 | 0.42 | 0.51 | 0.46 | 0.38 |
| $P_2O_5$ | 0.17 | 0.06 | 0.03 | 0.08 | 0.07 | 0.09 | 0.09 | 0.07 |
| MnO | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.14 | 0.09 | 0.00 |
| BaO | 0.12 | 0.16 | 0.18 | 0.12 | 0.15 | 0.17 | 0.12 | 0.14 |
| L.O.I. | 2.27 | 2.37 | 3.46 | 2.72 | 3.27 | 2.65 | 2.63 | 2.52 |
| TOTAL | 99.62 | 100.76 | 100.63 | 100.08 | 99.49 | 100.23 | 101.03 | 100.04 |
| *S | 0.23 | 0.00 | 0.02 | 0.10 | 0.13 | 0.18 | 0.17 | 0.14 |
| | | | | | | | | |
| Rb | 270 | 230 | 203 | 262 | 209 | 253 | 202 | 158 |
| Ba | 1070 | 1430 | 1600 | 1075 | 1340 | 1520 | 1075 | 1250 |
| Sr | 14 | 75 | 39 | 12 | 35 | 52 | 95 | 21 |
| La | 36 | 32 | 20 | 23 | 28 | 55 | 24 | 25 |
| Ce | 70 | 60 | 70 | 40 | 80 | 30 | 50 | 70 |
| Y | 44 | 41 | 26 | 50 | 43 | 43 | 43 | 34 |
| Th | 19 | 20 | 25 | 17 | 31 | 19 | 25 | 27 |
| Zr | 285 | 264 | 302 | 334 | 267 | 286 | 298 | 282 |
| Nb | 21 | 19 | 18 | 9 | 12 | 12 | 20 | 18 |
| Ti | 2340 | 2460 | 2815 | 2875 | 2516 | 3055 | 2755 | 2276 |
| Ni | 3 | 5 | 2 | 11 | 10 | 11 | 1 | 2 |
| Sc | 8 | 10 | 13 | 11 | 8 | 11 | 10 | 10 |
| V | 36 | 58 | 53 | 48 | 48 | 68 | 54 | 43 |
| Cr | 20 | 28 | 28 | 22 | 15 | 34 | 16 | 15 |
| Li | 5 | 14 | 23 | 11 | 11 | 17 | 29 | 20 |
| Ga | 24 | 17 | 23 | 22 | 17 | 21 | 18 | 18 |
| Ge | 2 | 1 | 2 | 2 | 0 | 3 | 2 | 2 |
| Cu | 6 | 15 | 0 | 0 | 27 | 30 | 0 | 0 |
| Pb | 70 | 0 | 0 | 0 | 51 | 126 | 35 | 3 |
| Zn | 220 | 33 | 24 | 31 | 43 | 285 | 290 | 34 |

TABLE V. Analyses of rocks from the Jukes-Darwin area - Clark Volcanics.

| Number | 41186 | 41193 | 41194 |
|---|---|---|---|
| $SiO_2$ | 80.78 | 64.07 | 76.57 |
| $Al_2O_3$ | 11.33 | 14.20 | 13.42 |
| *$Fe_2O_3$ | 0.53 | 6.73 | 2.59 |
| MgO | 0.21 | 1.72 | 0.40 |
| CaO | 0.02 | 2.61 | 0.12 |
| $Na_2O$ | 2.45 | 3.85 | 2.01 |
| $K_2O$ | 3.03 | 1.70 | 3.31 |
| $TiO_2$ | 0.16 | 0.74 | 0.23 |
| $P_2O_5$ | 0.01 | 0.14 | 0.02 |
| MnO | 0.00 | 0.07 | 0.01 |
| BaO | 0.07 | 0.05 | 0.03 |
| L.O.I. | 1.14 | 3.80 | 1.71 |
| TOTAL | 99.73 | 99.63 | 100.42 |
| *S | 0.00 | 0.20 | 0.00 |
| | | | |
| Rb | 116 | 68 | 232 |
| Ba | 720 | 496 | 232 |
| Sr | 23 | 164 | 23 |
| La | 120 | 26 | 75 |
| Ce | 100 | 15 | 50 |
| Y | 43 | 40 | 42 |
| Th | 27 | 19 | 34 |
| Zr | 145 | 240 | 175 |
| Nb | 10 | 7 | 12 |
| Ti | 958 | 4433 | 1378 |
| Ni | 3 | 1 | 4 |
| Sc | 2 | 19 | 4 |
| V | 18 | 119 | 30 |
| Cr | 15 | 11 | 13 |
| Li | 8 | 8 | 20 |
| Ga | 12 | 23 | 26 |
| Ge | 1 | 5 | 3 |
| Cu | 0 | 30 | 0 |
| Pb | 67 | 62 | 13 |
| Zn | 14 | 110 | 40 |

TABLE VI. Analyses of rocks from the Lyell-Huxley area - Intercolonial Volcanics Correlates.

| Number | 41404 | 41406 | 41408 | 41412 | 41413 | 41414 | 41415 | 41416 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 74.80 | 74.87 | 69.36 | 73.09 | 58.40 | 75.56 | 73.37 | 51.48 |
| $Al_2O_3$ | 12.62 | 13.19 | 13.26 | 11.76 | 19.34 | 14.02 | 13.07 | 17.55 |
| *$Fe_2O_3$ | 3.18 | 2.38 | 5.71 | 5.64 | 7.36 | 3.06 | 3.18 | 11.25 |
| MgO | 0.57 | 0.34 | 0.66 | 0.67 | 2.66 | 0.71 | 0.70 | 3.52 |
| CaO | 0.04 | 0.00 | 0.00 | 0.06 | 0.02 | 0.01 | 0.03 | 0.93 |
| $Na_2O$ | 3.09 | 3.76 | 0.22 | 1.97 | 2.46 | 0.33 | 2.69 | 5.13 |
| $K_2O$ | 4.50 | 4.09 | 8.21 | 4.84 | 3.59 | 3.43 | 4.88 | 4.12 |
| $TiO_2$ | 0.26 | 0.30 | 0.36 | 0.35 | 0.58 | 0.25 | 0.33 | 0.75 |
| $P_2O_5$ | 0.04 | 0.03 | 0.03 | 0.06 | 0.09 | 0.05 | 0.05 | 0.77 |
| MnO | 0.00 | 0.00 | 0.04 | 0.08 | 0.06 | 0.01 | 0.01 | 0.01 |
| BaO | 0.12 | 0.08 | 0.31 | 0.28 | 0.14 | 0.07 | 0.13 | 0.20 |
| L.O.I. | 1.03 | 1.90 | 1.37 | 2.36 | 5.22 | 3.27 | 2.21 | 3.45 |
| TOTAL | 100.25 | 100.94 | 99.53 | 101.16 | 99.92 | 100.77 | 100.65 | 99.16 |
| *S | 0.12 | 0.10 | 0.14 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Rb | 135 | 130 | 228 | 102 | 157 | 170 | 258 | 113 |
| Ba | 1075 | 720 | 2775 | 2500 | 1250 | 694 | 1190 | 1810 |
| Sr | 150 | 27 | 68 | 73 | 69 | 7 | 7 | 270 |
| La | 42 | 32 | 56 | 35 | 5 | 25 | 37 | 118 |
| Ce | 60 | 0 | 100 | 100 | 20 | 40 | 70 | 230 |
| Y | 43 | 35 | 40 | 45 | 66 | 43 | 50 | 32 |
| Th | 29 | 28 | 24 | 30 | 33 | 22 | 26 | 35 |
| Zr | 276 | 326 | 245 | 252 | 145 | 343 | 334 | 198 |
| Nb | 13 | 14 | 12 | 11 | 3 | 8 | 7 | 7 |
| Ti | 1560 | 1800 | 2160 | 2100 | 3474 | 1500 | 1980 | 4493 |
| Ni | 2 | 4 | 10 | 2 | 4 | 0 | 1 | 38 |
| Sc | 9 | 7 | 11 | 9 | 19 | 7 | 9 | 29 |
| V | 20 | 23 | 32 | 36 | 182 | 63 | 47 | 323 |
| Cr | 15 | 20 | 48 | 27 | 28 | 29 | 32 | 70 |
| Li | 0 | 12 | 0 | 3 | 24 | 7 | 0 | 15 |
| Ga | 18 | 14 | 19 | 12 | 26 | 17 | 17 | 21 |
| Ge | 2 | 4 | 1 | 6 | 8 | 1 | 3 | 2 |
| Cu | 0 | 0 | 161 | 43 | 41 | 0 | 0 | 24 |
| Pb | 27 | 5 | 10 | 33 | 79 | 27 | 20 | 0 |
| Zn | 31 | 30 | 108 | 95 | 166 | 49 | 43 | 408 |

TABLE VI continued. Analyses of rocks from the Lyell-Huxley area - Intercolonial Volcanics Correlates.

| Number | 41446 | 41450 | 41451 | 41452 | 41453 | 41454 | 41455 | 41456 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 74.52 | 72.58 | 55.83 | 77.98 | 74.86 | 74.37 | 85.64 | 69.31 |
| $Al_2O_3$ | 13.41 | 11.32 | 15.53 | 12.30 | 12.00 | 11.30 | 6.69 | 17.73 |
| *$Fe_2O_3$ | 3.11 | 7.37 | 17.43 | 2.72 | 7.14 | 7.13 | 3.08 | 2.19 |
| MgO | 0.81 | 1.41 | 2.64 | 0.01 | 0.77 | 0.91 | 0.08 | 1.12 |
| CaO | 0.00 | 0.00 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Na_2O$ | 0.04 | 0.03 | 0.01 | 0.08 | 0.04 | 0.07 | 0.08 | 0.04 |
| $K_2O$ | 5.97 | 2.58 | 3.39 | 3.42 | 2.91 | 2.23 | 1.73 | 5.74 |
| $TiO_2$ | 0.34 | 0.21 | 0.61 | 0.24 | 0.22 | 0.13 | 0.12 | 0.48 |
| $P_2O_5$ | 0.06 | 0.04 | 0.24 | 0.04 | 0.02 | 0.02 | 0.03 | 0.01 |
| MnO | 0.03 | 0.12 | 0.32 | 0.00 | 0.14 | 0.10 | 0.00 | 0.00 |
| BaO | 0.07 | 0.11 | 0.23 | 0.04 | 0.17 | 0.06 | 0.04 | 0.19 |
| L.O.I. | 1.90 | 2.64 | 4.05 | 3.06 | 2.22 | 2.63 | 2.60 | 3.45 |
| TOTAL | 100.26 | 98.41 | 100.57 | 99.86 | 100.49 | 98.95 | 100.09 | 100.26 |
| *S | 0.16 | 0.00 | 0.08 | 2.15 | 0.04 | 0.68 | 1.88 | 0.00 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Rb | 218 | 80 | 98 | 65 | 98 | 85 | 60 | 200 |
| Ba | 592 | 985 | 2024 | 360 | 1540 | 540 | 433 | 1680 |
| Sr | 33 | 7 | 7 | 13 | 8 | 6 | 57 | 27 |
| La | 23 | 43 | 57 | 3 | 17 | 10 | 12 | 23 |
| Ce | 50 | 80 | 200 | 10 | 150 | 80 | 30 | 40 |
| Y | 39 | 67 | 39 | 24 | 39 | 51 | 33 | 56 |
| Th | 22 | 25 | 30 | 24 | 28 | 25 | 25 | 43 |
| Zr | 288 | 286 | 190 | 280 | 285 | 225 | 120 | 277 |
| Nb | 4 | 6 | 3 | 6 | 8 | 8 | 2 | 10 |
| Ti | 2040 | 1260 | 3650 | 1440 | 1320 | 780 | 720 | 2880 |
| Ni | 8 | 3 | 41 | 17 | 8 | 9 | 14 | 15 |
| Sc | 26 | 8 | 31 | 9 | 7 | 8 | 4 | 17 |
| V | 42 | 37 | 204 | 56 | 30 | 34 | 35 | 105 |
| Cr | 33 | 24 | 240 | 47 | 32 | 33 | 42 | 48 |
| Li | 0 | 10 | 18 | 0 | 2 | 30 | 5 | 26 |
| Ga | 15 | 16 | 20 | 8 | 15 | 18 | 24 | 30 |
| Ge | 0 | 3 | 5 | 2 | 1 | 5 | 6 | 6 |
| Cu | 0 | 33 | 566 | 59 | 5 | 480 | 64 | 8 |
| Pb | 19 | 30 | 22 | 18 | 0 | 8 | 28 | 22 |
| Zn | 29 | 284 | 605 | 0 | 203 | 374 | 0 | 0 |

TABLE VII. Analyses of rocks from the Lyell-Huxley area - Intercolonial Volcanics correlates, mineralized and associated.

| Number | 41435 | 41436 | 41437 | 41438 | 41439 | 41440 | 41441 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 60.48 | 80.78 | 79.69 | 58.08 | 71.87 | 77.16 | 81.11 |
| $Al_2O_3$ | 20.96 | 10.40 | 11.18 | 21.11 | 13.62 | 12.70 | 10.66 |
| *$Fe_2O_3$ | 5.00 | 1.50 | 1.31 | 7.32 | 5.54 | 1.79 | 1.98 |
| MgO | 1.30 | 0.27 | 0.48 | 1.36 | 1.14 | 0.36 | 0.48 |
| CaO | 0.01 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.01 |
| $Na_2O$ | 0.07 | 0.07 | 0.04 | 0.07 | 0.06 | 0.08 | 0.06 |
| $K_2O$ | 6.33 | 3.70 | 3.91 | 6.63 | 3.76 | 4.33 | 3.57 |
| $TiO_2$ | 0.66 | 0.23 | 0.24 | 0.66 | 0.23 | 0.37 | 0.22 |
| $P_2O_5$ | 0.08 | 0.02 | 0.00 | 0.13 | 0.04 | 0.09 | 0.02 |
| MnO | 0.04 | 0.00 | 0.00 | 0.21 | 0.07 | 0.00 | 0.00 |
| BaO | 0.24 | 0.10 | 0.10 | 0.31 | 0.24 | 0.21 | 0.08 |
| L.O.I. | 4.41 | 2.13 | 2.90 | 3.53 | 3.07 | 1.94 | 2.00 |
| TOTAL | 99.58 | 99.20 | 99.85 | 99.50 | 99.64 | 99.03 | 100.19 |
| *S | 0.00 | 0.00 | 0.00 | 0.14 | 0.05 | 0.10 | 1.14 |
| | | | | | | | |
| Rb | 263 | 150 | 155 | 114 | 73 | 160 | 103 |
| Ba | 2130 | 933 | 930 | 2780 | 2120 | 1880 | 742 |
| Sr | 27 | 6 | 6 | 16 | 14 | 37 | 5 |
| | | | | | | | |
| La | 33 | 20 | 25 | 0 | 60 | 22 | 33 |
| Ce | 90 | 50 | 50 | 20 | 160 | 100 | 50 |
| Y | 41 | 33 | 34 | 59 | 81 | 44 | 43 |
| | | | | | | | |
| Th | - | 27 | 23 | - | - | - | - |
| Zr | 116 | 226 | 253 | 101 | 280 | 225 | 232 |
| Nb | 3 | 7 | 7 | 4 | 4 | 8 | 6 |
| Ti | 3970 | 1380 | 1440 | 3950 | 1380 | 2220 | 1320 |
| | | | | | | | |
| Ni | 20 | 8 | 5 | 18 | 20 | 7 | 14 |
| Sc | 19 | 6 | 7 | 18 | 9 | 10 | 4 |
| V | 208 | 43 | 46 | 212 | 36 | 91 | 42 |
| Cr | 33 | 28 | 30 | 35 | 15 | 38 | 27 |
| Li | 18 | 12 | 3 | 11 | 3 | 0 | 0 |
| Ga | 23 | 17 | 14 | 16 | 9 | 8 | 7 |
| Ge | 0 | 0 | 4 | 1 | 0 | 3 | 3 |
| | | | | | | | |
| Cu | 18 | 0 | 0 | 238 | 84 | 0 | 2 |
| Pb | 575 | 11 | 6 | 440 | 3000 | 500 | 900 |
| Zn | 226 | 53 | 12 | 385 | 250 | 9 | 592 |

TABLE VII continued. Analyses of rocks from the Lyell-Huxley area - Intercolonial Volcanics correlates, mineralized and associated.

| Number | 41442 | 41443 | 41444 | 41445 | 41449 | 37887 | 41465 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 74.86 | 76.00 | 74.64 | 65.34 | 71.72 | 59.23 | 70.67 |
| $Al_2O_3$ | 12.90 | 11.55 | 15.27 | 11.37 | 8.72 | 11.00 | 11.63 |
| *$Fe_2O_3$ | 3.95 | 4.74 | 1.00 | 15.04 | 12.91 | 10.56 | 7.29 |
| MgO | 0.57 | 0.31 | 0.65 | 1.86 | 1.93 | 1.44 | 0.80 |
| CaO | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 3.13 | 0.08 |
| $Na_2O$ | 0.08 | 0.08 | 0.08 | 0.03 | 0.00 | 0.08 | 0.08 |
| $K_2O$ | 4.17 | 3.65 | 4.95 | 1.85 | 1.01 | 3.32 | 3.46 |
| $TiO_2$ | 0.22 | 0.19 | 0.49 | 0.31 | 0.12 | 0.25 | 0.24 |
| $P_2O_5$ | 0.03 | 0.03 | 0.09 | 0.06 | 0.00 | 0.42 | 0.09 |
| MnO | 0.01 | 0.01 | 0.01 | 0.34 | 0.18 | 0.53 | 0.05 |
| BaO | 0.24 | 0.20 | 0.10 | 0.08 | 0.02 | 0.27 | 0.59 |
| L.O.I. | 2.30 | 3.43 | 2.20 | 3.91 | 2.97 | 5.28 | 4.97 |
| TOTAL | 99.33 | 100.19 | 99.51 | 100.19 | 99.97† | 98.98$^{x}$ | 100.72$^{+}$ |
| %S | 0.27 | 2.66 | 0.19 | 1.66 | 0.68 | 4.68 | 2.78 |
| Rb | 167 | 150 | 161 | 62 | 47 | 82 | 95 |
| Ba | 2150 | 1790 | 900 | 745 | 175 | 2420 | 5280 |
| Sr | 12 | 9 | 28 | 35 | 7 | 43 | 108 |
| La | 35 | 5 | 62 | 0 | 0 | 80 | 123 |
| Ce | 130 | 70 | 80 | 100 | 50 | 200 | 400 |
| Y | 54 | 49 | 47 | 53 | 35 | 61 | 24 |
| Th | 27 | 22 | 31 | 8 | 23 | - | 22 |
| Zr | 287 | 234 | 234 | 158 | 183 | 141 | 207 |
| Nb | 11 | 7 | 7 | 1 | 0 | 14 | 6 |
| Ti | 1320 | 1140 | 2940 | 1860 | 720 | 1438 | 1440 |
| Ni | 11 | 0 | 6 | 9 | 6 | 39 | 11 |
| Sc | 8 | 7 | 12 | 8 | 6 | 12 | 7 |
| V | 31 | 26 | 49 | 46 | 46 | 136 | 67 |
| Cr | 26 | 37 | 38 | 14 | 20 | - | 32 |
| Li | 12 | 0 | 0 | 10 | 12 | 17 | 7 |
| Ga | 12 | 12 | 26 | 16 | 11 | 8 | 17 |
| Ge | 3 | 0 | 4 | 0 | 6 | 5 | 3 |
| Cu | 116 | 0 | 0 | 15 | 2296 | 24280 | 6150 |
| Pb | 55 | 17 | 32 | 162 | 25 | 750 | 0 |
| Zn | 37 | 0 | 0 | 390 | 171 | 890 | 28 |

† includes 0.37% CuO, 0.02% ZnO

x includes 3.04% CuO, 0.13% ZnO

\+ includes 0.77% CuO.

TABLE VIII. Analyses of rocks from the Lyell-Huxley area - Clark Volcanics correlates

| Number | 41419 | 41420 | 41421 | 41422 | 41423 | 41427 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 76.86 | 77.74 | 66.80 | 47.61 | 71.87 | 66.32 |
| $Al_2O_3$ | 13.84 | 12.84 | 15.01 | 15.36 | 15.07 | 16.11 |
| *$Fe_2O_3$ | 2.81 | 1.29 | 4.68 | 9.58 | 2.74 | 7.17 |
| MgO | 0.56 | 0.56 | 2.00 | 10.36 | 1.74 | 1.70 |
| CaO | 0.00 | 0.00 | 0.11 | 9.78 | 0.00 | 0.12 |
| $Na_2O$ | 0.04 | 0.07 | 3.20 | 2.95 | 0.07 | 1.78 |
| $K_2O$ | 3.95 | 4.38 | 4.02 | 0.13 | 3.62 | 2.95 |
| $TiO_2$ | 0.21 | 0.39 | 0.63 | 0.96 | 0.54 | 0.59 |
| $P_2O_5$ | 0.03 | 0.02 | 0.09 | 0.03 | 0.01 | 0.12 |
| MnO | 0.00 | 0.00 | 0.01 | 0.14 | 0.00 | 0.02 |
| BaO | 0.03 | 0.08 | 0.11 | 0.01 | 0.04 | 0.06 |
| L.O.I. | 2.04 | 1.93 | 2.52 | 3.92 | 3.50 | 3.15 |
| TOTAL | 100.37 | 99.30 | 99.18 | 100.83 | 99.20 | 100.09 |
| ⁎S | 0.12 | 0.13 | 0.04 | 0.34 | 0.12 | 0.07 |
| Rb | 140 | 205 | 110 | 1 | 160 | 120 |
| Ba | 235 | 812 | 995 | 72 | 417 | 568 |
| Sr | 4 | 5 | 148 | 162 | 6 | 52 |
| La | 26 | 23 | 17 | 48 | 20 | 12 |
| Ce | 40 | 50 | 50 | 0 | 10 | 30 |
| Y | 43 | 36 | 34 | 25 | 39 | 37 |
| Th | 30 | 26 | 20 | 1 | 24 | 18 |
| Zr | 233 | 260 | 270 | 9 | 327 | 290 |
| Nb | 9 | 10 | 10 | 0 | 9 | 8 |
| Ti | 1260 | 2340 | 3770 | 5750 | 3235 | 3530 |
| Ni | 8 | 13 | 30 | 300 | 27 | 17 |
| Sc | 6 | 7 | 16 | 29 | 13 | 20 |
| V | 52 | 81 | 137 | 225 | 120 | 126 |
| Cr | 28 | 49 | 109 | 505 | 94 | 37 |
| Li | 1 | 0 | 10 | 33 | 4 | 27 |
| Ga | 18 | 15 | 16 | 18 | 19 | 16 |
| Ge | 2 | 4 | 1 | 3 | 3 | 0 |
| Cu | 0 | 0 | 47 | 44 | 0 | 6 |
| Pb | 5 | 5 | 5 | 0 | 0 | 5 |
| Zn | 40 | 0 | 68 | 54 | 43 | 58 |

TABLE VIII continued. Analyses of rocks from the Lyell-Huxley area - Clark Volcanics correlates.

| Number | 41428 | 41429 | 41430 | 41432 | 41434 | 41461 | 41462 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 52.70 | 73.52 | 79.18 | 78.88 | 76.28 | 54.80 | 69.45 |
| $Al_2O_3$ | 18.40 | 15.34 | 13.28 | 13.26 | 14.69 | 18.18 | 13.22 |
| $*Fe_2O_3$ | 10.35 | 0.73 | 0.10 | 0.19 | 1.07 | 8.37 | 3.36 |
| MgO | 5.48 | 0.37 | 0.05 | 0.09 | 0.50 | 2.59 | 0.76 |
| CaO | 2.85 | 0.02 | 0.02 | 0.04 | 0.01 | 7.15 | 2.66 |
| $Na_2O$ | 2.10 | 2.71 | 6.56 | 6.27 | 0.10 | 3.58 | 2.97 |
| $K_2O$ | 2.00 | 4.16 | 0.20 | 0.45 | 4.82 | 1.75 | 4.38 |
| $TiO_2$ | 0.61 | 0.18 | 0.28 | 0.30 | 0.15 | 0.59 | 0.45 |
| $P_2O_5$ | 0.32 | 0.01 | 0.05 | 0.03 | 0.02 | 0.47 | 0.06 |
| MnO | 0.10 | 0.00 | 0.01 | 0.02 | 0.02 | 0.09 | 0.04 |
| BaO | 0.12 | 0.08 | 0.01 | 0.01 | 0.07 | 0.12 | 0.10 |
| L.O.I. | 5.09 | 2.89 | 1.26 | 1.24 | 2.81 | 2.44 | 3.13 |
| TOTAL | 100.12 | 100.01 | 101.00 | 100.78 | 100.54 | 100.13 | 100.58 |
| *S | 0.02 | 0.00 | 0.06 | 0.05 | 0.00 | 0.00 | 0.14 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rb | 55 | 180 | 2 | 2 | 203 | 34 | 157 |
| Ba | 1075 | 770 | 62 | 89 | 694 | 1048 | 928 |
| Sr | 745 | 117 | 69 | 93 | 12 | 1490 | 100 |
| La | 27 | 45 | 40 | 18 | 40 | 105 | 45 |
| Ce | 30 | 50 | 30 | 20 | 70 | 180 | 40 |
| Y | 23 | 25 | 26 | 27 | 33 | 41 | 54 |
| Th | 19 | 43 | 35 | 20 | 56 | 33 | 21 |
| Zr | 99 | 154 | 204 | 240 | 133 | 208 | 301 |
| Nb | 4 | 16 | 8 | 10 | 14 | 0 | 8 |
| Ti | 3650 | 1050 | 1650 | 1800 | 900 | 3504 | 2700 |
| Ni | 55 | 6 | 8 | 2 | 4 | 27 | 29 |
| Sc | 32 | 4 | 6 | 7 | 3 | 20 | 13 |
| V | 363 | 53 | 57 | 57 | 44 | 225 | 154 |
| Cr | 40 | 28 | 26 | 19 | 24 | 51 | 101 |
| Li | 24 | 1 | 0 | 0 | 18 | 15 | 7 |
| Ga | 20 | 18 | 17 | 17 | 21 | 20 | 16 |
| Ge | 0 | 0 | 2 | 0 | 2 | 5 | 5 |
| Cu | 24 | 0 | 0 | 0 | 0 | 120 | 0 |
| Pb | 63 | 0 | 3 | 280 | 4 | 5 | 2 |
| Zn | 54 | 0 | 0 | 0 | 0 | 37 | 44 |

TABLE IX. Analyses of rocks from the Lyell-Huxley area - stratigraphic relations doubtful.

| Number | 41417 | 41418 | 37891 | 41447 | 41457 | 41458 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 73.98 | 71.74 | 68.55 | 61.07 | 69.99 | 54.78 |
| $Al_2O_3$ | 14.26 | 15.22 | 15.84 | 13.64 | 12.00 | 21.09 |
| *$Fe_2O_3$ | 3.27 | 2.63 | 5.48 | 7.18 | 9.07 | 7.89 |
| MgO | 0.73 | 0.48 | 0.68 | 3.14 | 2.34 | 2.80 |
| CaO | 0.02 | 0.00 | 0.22 | 5.23 | 0.00 | 0.52 |
| $Na_2O$ | 3.52 | 1.20 | 4.92 | 4.35 | 0.86 | 3.33 |
| $K_2O$ | 2.56 | 4.14 | 3.20 | 2.51 | 1.48 | 4.47 |
| $TiO_2$ | 0.39 | 0.44 | 0.41 | 0.52 | 0.31 | 0.62 |
| $P_2O_5$ | 0.06 | 0.02 | 0.22 | 0.27 | 0.05 | 0.26 |
| MnO | 0.00 | 0.00 | 0.04 | 0.21 | 0.11 | 0.07 |
| BaO | 0.08 | 0.06 | 0.12 | 0.06 | 0.05 | 0.25 |
| L.O.I. | 1.78 | 3.64 | 1.71 | 1.44 | 3.46 | 3.83 |
| TOTAL | 100.65 | 99.57 | 101.39 | 99.62 | 99.72 | 99.91 |
| *S | 0.05 | 0.14 | 0.04 | 0.11 | 0.00 | 0.02 |
| Rb | 90 | 142 | 45 | 56 | 47 | 110 |
| Ba | 753 | 536 | 1075 | 608 | 493 | 2240 |
| Sr | 70 | 3 | 176 | 272 | 22 | 240 |
| La | 35 | 30 | 64 | 80 | 28 | 25 |
| Ce | 50 | 40 | 100 | 60 | 150 | 120 |
| Y | 42 | 43 | 18 | 41 | 52 | 34 |
| Th | 14 | 24 | 30 | 25 | 21 | 25 |
| Zr | 303 | 325 | 131 | 229 | 311 | 143 |
| Nb | 5 | 5 | 12 | 1 | 8 | 7 |
| Ti | 3340 | 2636 | 2456 | 3115 | 1860 | 3710 |
| Ni | 1 | 1 | 16 | 45 | 12 | 32 |
| Sc | 9 | 10 | 20 | 27 | 6 | 20 |
| V | 51 | 52 | 121 | 184 | 41 | 227 |
| Cr | 27 | 33 | - | 190 | 20 | 52 |
| Li | 10 | 10 | 17 | 0 | 30 | 30 |
| Ga | 15 | 19 | 15 | 15 | 12 | 23 |
| Ge | 3 | 3 | 3 | 3 | 8 | 2 |
| Cu | 0 | 0 | 33 | 30 | 41 | 62 |
| Pb | 0 | 4 | 16 | 15 | 7 | 6 |
| Zn | 46 | 59 | 45 | 34 | 131 | 164 |

TABLE X. Analyses of rocks from the Elliott Bay area - granitic intrusions.

| Number | 41468 | 41469 | 41470 | 41471 | 41472 | 41473 | 41475 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 78.13 | 76.13 | 70.27 | 72.81 | 75.37 | 71.27 | 67.67 |
| $Al_2O_3$ | 12.11 | 12.42 | 13.36 | 13.34 | 12.76 | 13.31 | 13.14 |
| *$Fe_2O_3$ | 1.01 | 1.75 | 3.79 | 3.11 | 1.89 | 4.47 | 6.88 |
| MgO | 0.06 | 0.13 | 2.09 | 0.65 | 0.24 | 1.09 | 2.64 |
| CaO | 0.20 | 0.11 | 0.90 | 1.30 | 1.26 | 1.61 | 0.79 |
| $Na_2O$ | 2.80 | 2.47 | 2.48 | 2.39 | 3.01 | 1.55 | 1.03 |
| $K_2O$ | 5.88 | 6.10 | 5.37 | 5.11 | 4.59 | 3.68 | 4.24 |
| $TiO_2$ | 0.11 | 0.16 | 0.43 | 0.42 | 0.20 | 0.42 | 0.47 |
| $P_2O_5$ | 0.01 | 0.04 | 0.10 | 0.06 | 0.04 | 0.06 | 0.13 |
| MnO | 0.04 | 0.05 | 0.11 | 0.05 | 0.04 | 0.05 | 0.73 |
| BaO | 0.01 | 0.02 | 0.13 | 0.12 | 0.10 | 0.08 | 0.16 |
| L.O.I. | 0.46 | 0.62 | 1.92 | 0.92 | 0.62 | 1.93 | 2.34 |
| TOTAL | 100.82 | 100.00 | 100.95 | 100.28 | 100.12 | 99.52 | 100.22 |
| *S | 0.06 | 0.08 | 0.06 | 0.06 | 0.05 | 0.08 | 0.41 |
| | | | | | | | |
| Rb | 368 | 380 | 236 | 213 | 161 | 204 | 177 |
| Ba | 104 | 176 | 1160 | 1075 | 870 | 716 | 1430 |
| Sr | 56 | 75 | 126 | 141 | 158 | 151 | 70 |
| La | 70 | 30 | 62 | 33 | 56 | 60 | 35 |
| Ce | 120 | 30 | 60 | 20 | 90 | 70 | 80 |
| Y | 111 | 77 | 44 | 39 | 59 | 19 | 50 |
| Th | 75 | 77 | 40 | 41 | 45 | 32 | 17 |
| Zr | 90 | 168 | 182 | 303 | 176 | 198 | 200 |
| Nb | 19 | 15 | 6 | 9 | 8 | 5 | 3 |
| Ti | 560 | 960 | 2580 | 2520 | 1200 | 2520 | 2815 |
| Ni | 9 | 14 | 33 | 10 | 5 | 14 | 67 |
| Sc | 3 | 5 | 12 | 7 | 4 | 8 | 15 |
| V | 46 | 47 | 82 | 57 | 32 | 65 | 102 |
| Cr | 21 | 29 | 106 | 40 | 38 | 42 | 117 |
| Li | 0 | 0 | 17 | 0 | 2 | 15 | 6 |
| Ga | 31 | 28 | 28 | 24 | 28 | 25 | 16 |
| Ge | 4 | 9 | 4 | 4 | 8 | 8 | 8 |
| Cu | 0 | 0 | 22 | 0 | 10 | 0 | 180 |
| Pb | 20 | 43 | 48 | 20 | 14 | 16 | 435 |
| Zn | 0 | 0 | 92 | 0 | 0 | 0 | 284 |

TABLE XI. Analyses of rocks from the Elliott Bay area - Lewis River volcanics.

| Number | 41477 | 41479 | 41480 | 41481 | 41482 | 41483 | 41484 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 75.71 | 71.17 | 70.19 | 68.51 | 69.62 | 77.44 | 76.17 |
| $Al_2O_3$ | 12.74 | 14.13 | 14.13 | 14.29 | 13.05 | 11.85 | 11.70 |
| *$Fe_2O_3$ | 1.57 | 4.00 | 3.34 | 4.70 | 4.48 | 1.58 | 0.73 |
| MgO | 0.51 | 1.23 | 1.36 | 2.54 | 1.91 | 0.35 | 0.12 |
| CaO | 0.74 | 0.23 | 0.49 | 0.35 | 1.77 | 0.08 | 0.40 |
| $Na_2O$ | 2.44 | 1.65 | 1.64 | 2.81 | 2.58 | 2.62 | 4.09 |
| $K_2O$ | 4.03 | 4.87 | 7.34 | 4.37 | 4.53 | 3.95 | 3.04 |
| $TiO_2$ | 0.27 | 0.48 | 0.47 | 0.49 | 0.53 | 0.18 | 0.11 |
| $P_2O_5$ | 0.03 | 0.09 | 0.08 | 0.10 | 0.10 | 0.03 | 0.01 |
| MnO | 0.09 | 0.28 | 0.06 | 0.14 | 0.12 | 0.24 | 0.06 |
| BaO | 0.08 | 0.17 | 0.11 | 0.07 | 0.10 | 0.09 | 0.09 |
| L.O.I. | 1.68 | 1.54 | 1.12 | 1.41 | 1.41 | 1.06 | 4.18 |
| TOTAL | 99.89 | 99.84 | 100.33 | 99.78 | 100.20 | 99.47 | 100.70 |
| *S | 0.05 | 0.05 | 0.11 | 0.07 | 0.07 | 0.05 | 0.00 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Rb | 250 | 189 | 238 | 247 | 150 | 248 | 133 |
| Ba | 794 | 1522 | 985 | 704 | 980 | 912 | 886 |
| Sr | 138 | 144 | 258 | 103 | 200 | 148 | 120 |
| La | 53 | 14 | 100 | 18 | 38 | 58 | 75 |
| Ce | 60 | 10 | 120 | 10 | 30 | 100 | 150 |
| Y | 55 | 42 | 51 | 44 | 45 | 51 | 58 |
| Th | 36 | 30 | 38 | 28 | 29 | 32 | 42 |
| Zr | 200 | 227 | 275 | 238 | 262 | 124 | 109 |
| Nb | 6 | 4 | 8 | 6 | 4 | 4 | 5 |
| Ti | 1620 | 2875 | 2815 | 2940 | 3170 | 1080 | 660 |
| Ni | 12 | 13 | 18 | 18 | 25 | 14 | 11 |
| Sc | 7 | 11 | 13 | 15 | 14 | 4 | 3 |
| V | 54 | 93 | 98 | 118 | 98 | 23 | 22 |
| Cr | 22 | 55 | 67 | 105 | 69 | 21 | 18 |
| Li | 0 | 0 | 0 | 3 | 6 | 3 | 3 |
| Ga | 30 | 29 | 29 | 26 | 26 | 26 | 24 |
| Ge | 3 | 8 | 8 | 7 | 7 | 6 | 5 |
| Cu | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pb | 51 | 189 | 42 | 23 | 100 | 30 | 29 |
| Zn | 16 | 318 | 55 | 51 | 210 | 7 | 5 |

TABLE XII. Analyses of rocks from the Elliott Bay Area - Dyke Rocks.

| Number | 41489 | 41490 | 41491 | 41492 | 41493 | 41494 | 41495 | 41496 |
|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 76.53 | 55.72 | 59.38 | 55.97 | 50.41 | 49.08 | 49.58 | 46.28 |
| $Al_2O_3$ | 12.84 | 16.07 | 16.83 | 17.29 | 15.77 | 15.84 | 15.07 | 11.63 |
| *$Fe_2O_3$ | 1.40 | 6.18 | 6.54 | 8.49 | 8.06 | 8.66 | 9.90 | 11.59 |
| MgO | 0.18 | 3.53 | 3.64 | 4.51 | 5.94 | 8.61 | 7.58 | 13.16 |
| CaO | 0.11 | 6.57 | 4.60 | 6.06 | 7.10 | 4.47 | 5.29 | 7.51 |
| $Na_2O$ | 1.55 | 2.19 | 4.04 | 3.39 | 0.37 | 0.62 | 1.17 | 0.70 |
| $K_2O$ | 5.15 | 3.19 | 0.98 | 1.35 | 5.79 | 5.79 | 3.27 | 5.13 |
| $TiO_2$ | 0.11 | 0.54 | 0.62 | 1.27 | 1.04 | 1.00 | 0.94 | 0.97 |
| $P_2O_5$ | 0.03 | 0.18 | 0.20 | 0.32 | 0.57 | 0.55 | 0.52 | 0.72 |
| MnO | 0.03 | 0.14 | 0.15 | 0.12 | 0.45 | 0.57 | 0.82 | 0.23 |
| BaO | 0.08 | 0.08 | 0.02 | 0.05 | 0.17 | 0.11 | 0.08 | 0.48 |
| L.O.I. | 1.00 | 6.24 | 2.50 | 2.49 | 2.99 | 2.97 | 6.13 | 2.03 |
| TOTAL | 99.01 | 100.63 | 99.50 | 101.31 | 98.66 | 98.27 | 100.35 | 100.43 |
| ※S | 0.04 | 0.03 | 0.05 | 0.06 | 0.04 | 0.07 | 0.05 | 0.09 |
| | | | | | | | | |
| Rb | 280 | 240 | 223 | 56 | 252 | 460 | 173 | 404 |
| Ba | 684 | 710 | 205 | 512 | 1520 | 970 | 710 | 4300 |
| Sr | 73 | 362 | 570 | 80 | 250 | 194 | 240 | 532 |
| La | 23 | 40 | 30 | 50 | 120 | 85 | 75 | 115 |
| Ce | 0 | 10 | 10 | 10 | 70 | 70 | 60 | 200 |
| Y | 28 | 41 | 8 | 35 | 42 | 48 | 39 | 46 |
| Th | 48 | 20 | 25 | 20 | 27 | 29 | 19 | 57 |
| Zr | 64 | 95 | 129 | 206 | 294 | 278 | 252 | 120 |
| Nb | 5 | 0 | 0 | 8 | 2 | 0 | 2 | 0 |
| Ti | 600 | 3230 | 3710 | 7600 | 6230 | 5990 | 5631 | 5810 |
| Ni | 14 | 46 | 39 | 25 | 147 | 151 | 155 | 269 |
| Sc | 2 | 16 | 16 | 23 | 30 | 28 | 31 | 35 |
| V | 31 | 139 | 133 | 212 | 257 | 260 | 252 | 221 |
| Cr | 37 | 89 | 81 | 90 | 430 | 460 | 470 | 815 |
| Li | 3 | 12 | 14 | 0 | 6 | 18 | 32 | 36 |
| Ga | 23 | 27 | 27 | 31 | 31 | 28 | 27 | 28 |
| Ge | 5 | 3 | 8 | 4 | 8 | 6 | 4 | 1 |
| Cu | 0 | 108 | 0 | 12 | 70 | 8 | 13 | 15 |
| Pb | 20 | 22 | 24 | 22 | 22 | 133 | 72 | 32 |
| Zn | 0 | 55 | 60 | 46 | 42 | 288 | 336 | 142 |

TABLE XIII. Analyses of rocks from the Elliott Bay area - miscellaneous.

| Number | 41489 | 41497 | 41506 |
|---|---|---|---|
| $SiO_2$ | 61.50 | 52.64 | 48.95 |
| $Al_2O_3$ | 15.22 | 14.23 | 11.79 |
| *$Fe_2O_3$ | 10.32 | 8.44 | 11.08 |
| MgO | 0.75 | 3.80 | 10.51 |
| CaO | 0.15 | 6.87 | 9.72 |
| $Na_2O$ | 1.44 | 0.80 | 2.03 |
| $K_2O$ | 4.28 | 2.70 | 2.53 |
| $TiO_2$ | 0.73 | 0.57 | 0.94 |
| $P_2O_5$ | 0.04 | 0.13 | 0.11 |
| MnO | 0.01 | 0.17 | 0.18 |
| BaO | 0.07 | 0.05 | 0.01 |
| L.O.I. | 6.83 | 9.30 | 3.26 |
| TOTAL | 101.34 | 99.75 | 101.11 |
| ¤S | 5.57 | 0.10 | 0.10 |
| | | | |
| Rb | 185 | 142 | 0 |
| Ba | 700 | 423 | 46 |
| Sr | 45 | 106 | 128 |
| La | 25 | 43 | 67 |
| Ce | 90 | 40 | 0 |
| Y | 41 | 23 | 22 |
| Th | 38 | 25 | 7 |
| Zr | 329 | 60 | 19 |
| Nb | 3 | 0 | 0 |
| Ti | 4370 | 3415 | 5630 |
| Ni | 47 | 8 | 143 |
| Sc | 14 | 36 | 40 |
| V | 110 | 248 | 293 |
| Cr | 86 | 31 | 570 |
| Li | 9 | 15 | 0 |
| Ga | 27 | 27 | 27 |
| Ge | 5 | 5 | 5 |
| Cu | 3 | 30 | 6 |
| Pb | 24 | 18 | 8 |
| Zn | 0 | 132 | 46 |

TABLE XIV. Analyses of rocks from the Noddy Creek area - Noddy Creek volcanics.

| Number | 41524 | 41525 | 41526 | 41527 | 41528 | 41529 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 55.68 | 76.14 | 74.38 | 66.69 | 57.51 | 61.33 |
| $Al_2O_3$ | 17.04 | 14.02 | 11.77 | 15.80 | 15.75 | 14.71 |
| *$Fe_2O_3$ | 13.18 | 1.10 | 1.74 | 5.03 | 10.08 | 7.55 |
| MgO | 2.69 | 0.28 | 1.37 | 0.22 | 3.51 | 3.79 |
| CaO | 0.24 | 0.01 | 2.05 | 0.24 | 1.98 | 2.85 |
| $Na_2O$ | 6.48 | 3.28 | 0.09 | 3.54 | 3.49 | 4.64 |
| $K_2O$ | 0.09 | 3.64 | 3.61 | 6.06 | 2.43 | 3.46 |
| $TiO_2$ | 0.81 | 0.15 | 0.12 | 0.66 | 0.58 | 0.67 |
| $P_2O_5$ | 0.17 | 0.04 | 0.04 | 0.21 | 0.17 | 0.14 |
| MnO | 0.12 | 0.00 | 0.06 | 0.01 | 0.17 | 0.15 |
| BaO | 0.00 | 0.06 | 0.14 | 0.28 | 0.10 | 0.14 |
| L.O.I. | 2.85 | 1.37 | 4.75 | 1.03 | 4.11 | 1.71 |
| TOTAL | 99.35 | 100.09 | 100.12 | 99.77 | 99.88 | 101.14 |
| *S | 0.14 | 0.04 | 0.36 | 0.13 | 0.08 | 0.12 |
| | | | | | | |
| Rb | 0 | 141 | 132 | 143 | 62 | 82 |
| Ba | 40 | 620 | 1250 | 2510 | 910 | 1250 |
| Sr | 40 | 72 | 96 | 130 | 312 | 264 |
| La | 2 | 38 | 200 | 15 | 47 | 28 |
| Ce | 100 | 70 | 90 | 80 | 90 | 70 |
| Y | 24 | 22 | 60 | 34 | 47 | 35 |
| Th | 4 | 53 | 47 | 41 | 37 | 33 |
| Zr | 128 | 128 | 83 | 200 | 111 | 166 |
| Nb | 11 | 4 | 5 | 9 | 6 | 2 |
| Ti | 4850 | 900 | 720 | 3950 | 3475 | 4010 |
| Ni | 13 | 2 | 12 | 8 | 14 | 25 |
| Sc | 12 | 3 | 5 | 6 | 19 | 20 |
| V | 202 | 52 | 42 | 126 | 197 | 162 |
| Cr | 18 | 27 | 35 | 31 | 76 | 117 |
| Li | 30 | 5 | 6 | 0 | 21 | 18 |
| Ga | 23 | 27 | 22 | 27 | 28 | 25 |
| Ge | 1 | 11 | 4 | 5 | 4 | 6 |
| Cu | 0 | 0 | 0 | 0 | 20 | 0 |
| Pb | 0 | 14 | 31 | 20 | 43 | 19 |
| Zn | 68 | 0 | 0 | 0 | 70 | 60 |

TABLE XIV continued. Analyses of rocks from the Noddy Creek area - Noddy Creek volcanics.

| Number | 41530 | 41531 | 41533 | 41534 | 41535 | 41536 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 53.72 | 59.89 | 59.51 | 69.35 | 70.33 | 70.82 |
| $Al_2O_3$ | 17.18 | 14.44 | 14.74 | 15.65 | 14.77 | 14.76 |
| *$Fe_2O_3$ | 9.81 | 7.96 | 7.75 | 4.12 | 3.66 | 3.08 |
| MgO | 4.79 | 4.03 | 5.21 | 1.06 | 1.10 | 0.71 |
| CaO | 3.19 | 5.02 | 2.92 | 0.25 | 0.31 | 0.27 |
| $Na_2O$ | 3.82 | 2.89 | 4.66 | 5.17 | 4.12 | 3.93 |
| $K_2O$ | 4.32 | 2.71 | 2.18 | 1.83 | 3.95 | 4.70 |
| $TiO_2$ | 0.55 | 0.56 | 0.55 | 0.36 | 0.25 | 0.28 |
| $P_2O_5$ | 0.16 | 0.09 | 0.13 | 0.07 | 0.07 | 0.07 |
| MnO | 0.24 | 0.11 | 0.25 | 0.11 | 0.11 | 0.04 |
| BaO | 0.15 | 0.06 | 0.12 | 0.03 | 0.10 | 0.08 |
| L.O.I. | 2.21 | 2.22 | 1.99 | 1.65 | 1.20 | 1.00 |
| TOTAL | 100.14 | 99.98 | 100.01 | 99.65 | 99.97 | 99.74 |
| *S | 0.13 | 0.01 | 0.06 | 0.05 | 0.04 | 0.07 |
| Rb | 118 | 118 | 55 | 85 | 102 | 169 |
| Ba | 1340 | 594 | 1075 | 316 | 945 | 798 |
| Sr | 265 | 267 | 304 | 120 | 270 | 140 |
| La | 35 | 50 | 30 | 0 | 4 | 26 |
| Ce | 80 | 10 | 30 | 0 | 30 | 30 |
| Y | 31 | 39 | 28 | 29 | 31 | 35 |
| Th | 34 | 27 | 27 | 35 | 35 | 42 |
| Zr | 52 | 166 | 122 | 100 | 68 | 96 |
| Nb | 0 | 10 | 3 | 10 | 16 | 12 |
| Ti | 3300 | 3350 | 3295 | 2160 | 1500 | 1680 |
| Ni | 23 | 51 | 38 | 0 | 7 | 18 |
| Sc | 20 | 24 | 19 | 8 | 4 | 4 |
| V | 267 | 193 | 211 | 80 | 60 | 76 |
| Cr | 38 | 144 | 148 | 56 | 51 | 36 |
| Li | 36 | 0 | 27 | 30 | 15 | 15 |
| Ga | 27 | 24 | 27 | 25 | 26 | 27 |
| Ge | 4 | 7 | 10 | 4 | 11 | 8 |
| Cu | 18 | 6 | 53 | 0 | 0 | 0 |
| Pb | 18 | 13 | 20 | 100 | 14 | 21 |
| Zn | 34 | 27 | 136 | 41 | 28 | 76 |

TABLE XV. Analyses of rocks from the Noddy Creek area - intrusions.

| Number | 41509 | 41511 | 41513 | 41514 | 41515 |
|---|---|---|---|---|---|
| $SiO_2$ | 67.04 | 70.78 | 53.40 | 69.86 | 60.96 |
| $Al_2O_3$ | 14.81 | 13.66 | 17.72 | 14.39 | 14.15 |
| $^*Fe_2O_3$ | 6.17 | 4.16 | 9.63 | 4.38 | 6.68 |
| MgO | 0.82 | 1.92 | 4.31 | 0.76 | 5.54 |
| CaO | 0.46 | 0.14 | 4.36 | 0.25 | 4.06 |
| $Na_2O$ | 3.80 | 3.95 | 4.43 | 3.83 | 5.66 |
| $K_2O$ | 4.45 | 3.51 | 2.84 | 4.28 | 2.12 |
| $TiO_2$ | 0.39 | 0.31 | 0.70 | 0.26 | 0.46 |
| $P_2O_5$ | 0.11 | 0.07 | 0.24 | 0.11 | 0.09 |
| MnO | 0.16 | 0.06 | 0.16 | 0.04 | 0.11 |
| BaO | 0.09 | 0.09 | 0.07 | 0.07 | 0.04 |
| L.O.I. | 1.37 | 1.61 | 2.48 | 1.29 | 0.98 |
| TOTAL | 99.67 | 100.26 | 100.34 | 99.52 | 100.85 |
| *S | 0.15 | 0.00 | 0.35 | 0.05 | 0.09 |
| | | | | | |
| Rb | 215 | 94 | 34 | 186 | 14 |
| Ba | 814 | 838 | 680 | 650 | 387 |
| Sr | 52 | 79 | 590 | 72 | 144 |
| La | 27 | 56 | 26 | 36 | 28 |
| Ce | 20 | 110 | 60 | 30 | 20 |
| Y | 47 | 52 | 27 | 35 | 29 |
| Th | 18 | 23 | 5 | 34 | 20 |
| Zr | 229 | 246 | 111 | 163 | 87 |
| Nb | 0 | 8 | 1 | 9 | 0 |
| Ti | 2340 | 1860 | 4200 | 1557 | 2755 |
| Ni | 10 | 48 | 16 | 12 | 85 |
| Sc | 6 | 8 | 22 | 5 | 25 |
| V | 78 | 75 | 240 | 70 | 207 |
| Cr | 34 | 90 | 35 | 34 | 150 |
| Li | 12 | 12 | 24 | 12 | 0 |
| Ga | 17 | 17 | 20 | 29 | 24 |
| Ge | 0 | 0 | 1 | 3 | 4 |
| Cu | 18 | 3 | 12 | 3 | 0 |
| Pb | 0 | 0 | 12 | 40 | 12 |
| Zn | 65 | 153 | 70 | 25 | 0 |

TABLE XV continued. Analyses of rocks from the Noddy Creek area - intrusions.

| Number | 41516 | 41517 | 41518 | 41521 |
|---|---|---|---|---|
| $SiO_2$ | 54.61 | 60.27 | 53.60 | 61.93 |
| $Al_2O_3$ | 14.54 | 16.53 | 14.38 | 13.16 |
| $*Fe_2O_3$ | 9.79 | 8.01 | 9.53 | 5.15 |
| MgO | 7.00 | 2.64 | 6.77 | 9.48 |
| CaO | 4.47 | 1.42 | 4.49 | 3.29 |
| $Na_2O$ | 4.35 | 6.91 | 4.95 | 6.32 |
| $K_2O$ | 1.91 | 2.54 | 1.78 | 0.20 |
| $TiO_2$ | 0.49 | 0.75 | 0.54 | 0.24 |
| $P_2O_5$ | 0.11 | 0.12 | 0.10 | 0.09 |
| MnO | 0.17 | 0.06 | 0.16 | 0.12 |
| BaO | 0.10 | 0.01 | 0.03 | 0.01 |
| L.O.I. | 2.45 | 1.17 | 2.50 | 1.91 |
| TOTAL | 99.99 | 100.43 | 98.83 | 101.90 |
| *S | 0.02 | 0.13 | 0.07 | 0.09 |
| | | | | |
| Rb | 33 | 8 | 8 | 0 |
| Ba | 850 | 145 | 290 | 64 |
| Sr | 238 | 72 | 193 | 47 |
| | | | | |
| La | 44 | 14 | 27 | 0 |
| Ce | 80 | 50 | 30 | 0 |
| Y | 86 | 31 | 33 | 13 |
| | | | | |
| Th | 29 | 25 | 22 | 10 |
| Zr | 52 | 97 | 39 | 111 |
| Nb | 1 | 9 | 0 | 2 |
| Ti | 2940 | 4490 | 3230 | 1440 |
| | | | | |
| Ni | 65 | 10 | 176 | 137 |
| Sc | 31 | 17 | 25 | 15 |
| V | 229 | 218 | 247 | 92 |
| Cr | 165 | 27 | 380 | 300 |
| Li | 9 | 3 | 24 | 0 |
| Ga | 25 | 29 | 27 | 22 |
| Ge | 10 | 4 | 9 | 5 |
| | | | | |
| Cu | 0 | 3 | 50 | 15 |
| Pb | 18 | 16 | 16 | 13 |
| Zn | 36 | 23 | 84 | 19 |

TABLE XVI. Analyses of rocks from the Noddy Creek area - Birch Inlet volcanics.

| Number | 41507 | 41508 |
|---|---|---|
| $SiO_2$ | 47.08 | 48.02 |
| $Al_2O_3$ | 13.31 | 14.51 |
| *$Fe_2O_3$ | 14.21 | 11.46 |
| MgO | 6.78 | 9.05 |
| CaO | 8.92 | 10.79 |
| $Na_2O$ | 3.45 | 2.37 |
| $K_2O$ | 1.11 | 1.14 |
| $TiO_2$ | 2.41 | 0.75 |
| $P_2O_5$ | 0.22 | 0.07 |
| MnO | 0.23 | 0.16 |
| BaO | 0.03 | 0.01 |
| L.O.I. | 2.33 | 2.86 |
| TOTAL | 100.08 | 101.19 |
| *S | 0.06 | 0.11 |
| | | |
| Rb | 0 | 0 |
| Ba | 180 | 56 |
| Sr | 141 | 260 |
| La | 20 | 74 |
| Ce | 0 | 0 |
| Y | 31 | 31 |
| Th | 6 | 12 |
| Zr | 95 | 0 |
| Nb | 6 | 0 |
| Ti | 14440 | 4490 |
| Ni | 81 | 138 |
| Sc | 33 | 43 |
| V | 397 | 299 |
| Cr | 198 | 290 |
| Li | 0 | 6 |
| Ga | 40 | 28 |
| Ge | 8 | 10 |
| Cu | 370 | 70 |
| Pb | 12 | 8 |
| Zn | 79 | 45 |

TABLE XVII. Analyses of rocks from the Noddy Creek area - ultramafics.

| Number | 41543 | 41546 | 41550 |
|---|---|---|---|
| $SiO_2$ | 51.10 | 52.80 | 51.63 |
| $Al_2O_3$ | 6.27 | 7.16 | 8.76 |
| *$Fe_2O_3$ | 9.28 | 12.15 | 11.21 |
| MgO | 26.17 | 20.81 | 16.31 |
| CaO | 0.44 | 0.42 | 4.67 |
| $Na_2O$ | 0.07 | 0.04 | 0.93 |
| $K_2O$ | 0.01 | 0.20 | 0.05 |
| $TiO_2$ | 0.11 | 0.13 | 0.11 |
| $P_2O_5$ | 0.01 | 0.02 | 0.01 |
| MnO | 0.12 | 0.10 | 0.20 |
| BaO | 0.00 | 0.00 | 0.01 |
| L.O.I. | 6.70 | 6.03 | 5.48 |
| TOTAL | 100.28 | 99.86 | 99.37 |
| *S | 0.10 | 0.15 | 0.07 |
| Rb | 0 | 3 | 0 |
| Ba | 12 | 18 | 12 |
| Sr | 10 | 30 | 33 |
| La | 0 | 0 | 0 |
| Ce | 20 | 60 | 30 |
| Y | 0 | 11 | 4 |
| Th | 0 | 19 | 11 |
| Zr | 30 | 0 | 0 |
| Nb | 0 | 0 | 0 |
| Ti | 500 | 780 | 570 |
| Ni | 840 | 574 | 393 |
| Sc | 13 | 24 | 37 |
| V | 100 | 182 | 286 |
| Cr | 2670 | 2940 | 1150 |
| Li | 28 | 9 | 9 |
| Ga | 10 | 20 | 20 |
| Ge | 2 | 6 | 5 |
| Cu | 0 | 12 | 3 |
| Pb | 0 | 13 | 5 |
| Zn | 52 | 60 | 29 |

TABLE XVIII. Analyses of rocks from the Noddy Creek Area - lamprophyric dykes.

| Number | 41537 | 41538 | 41539 | 41540 | 41541 |
|---|---|---|---|---|---|
| $SiO_2$ | 57.86 | 56.71 | 41.66 | 45.21 | 40.56 |
| $Al_2O_3$ | 14.46 | 16.60 | 13.79 | 10.98 | 9.94 |
| $*Fe_2O_3$ | 6.47 | 6.78 | 8.30 | 7.36 | 8.48 |
| MgO | 3.97 | 3.21 | 19.17 | 18.86 | 23.84 |
| CaO | 3.42 | 3.21 | 5.09 | 5.81 | 5.48 |
| $Na_2O$ | 0.73 | 0.99 | 0.08 | 0.12 | 0.07 |
| $K_2O$ | 8.46 | 9.39 | 3.45 | 4.00 | 1.25 |
| $TiO_2$ | 0.79 | 0.60 | 0.98 | 1.12 | 1.03 |
| $P_2O_5$ | 0.46 | 0.33 | 0.62 | 0.34 | 0.35 |
| MnO | 0.11 | 0.13 | 0.30 | 0.65 | 1.69 |
| BaO | 0.50 | 0.59 | 0.22 | 0.13 | 0.08 |
| L.O.I. | 3.28 | 2.53 | 6.79 | 5.93 | 7.41 |
| TOTAL | 100.51 | 101.07 | 100.45 | 100.51 | 100.18 |
| *S | 0.10 | 0.02 | 0.10 | 0.04 | 0.32 |

| | | | | | |
|---|---|---|---|---|---|
| Rb | 255 | 333 | 185 | 246 | 98 |
| Ba | 4480 | 5280 | 1970 | 1160 | 677 |
| Sr | 234 | 498 | 175 | 104 | 50 |
| La | 112 | 130 | 67 | 70 | 26 |
| Ce | 200 | 170 | 120 | 40 | 30 |
| Y | 56 | 43 | 51 | 38 | 30 |
| Th | 50 | 43 | 45 | 55 | 43 |
| Zr | 247 | 229 | 272 | 354 | 320 |
| Nb | 15 | 3 | 13 | 19 | 17 |
| Ti | 4730 | 3600 | 5870 | 6710 | 6170 |
| Ni | 51 | 24 | 43 | 73 | 100 |
| Sc | 17 | 13 | 18 | 19 | 20 |
| V | 155 | 129 | 198 | 197 | 194 |
| Cr | 76 | 58 | 78 | 550 | 660 |
| Li | 15 | 15 | 77 | 62 | 95 |
| Ga | 26 | 25 | 24 | 23 | 26 |
| Ge | 9 | 3 | 9 | 10 | 6 |
| Cu | 18 | 18 | 50 | 0 | 0 |
| Pb | 48 | 49 | 29 | 18 | 9 |
| Zn | 42 | 9 | 28 | 26 | 95 |

TABLE XIX. Analyses of rocks from the Double Cove area - Lucas Creek volcanics and intrusion.

| Number | 41567 | 41569 | 41570 | 41571 | 41572 | 41575 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 50.47 | 47.81 | 49.10 | 50.95 | 44.61 | 44.80 |
| $Al_2O_3$ | 13.99 | 13.60 | 14.96 | 12.95 | 12.23 | 13.42 |
| *$Fe_2O_3$ | 12.41 | 14.76 | 12.29 | 12.57 | 8.00 | 11.52 |
| MgO | 6.09 | 5.66 | 7.14 | 8.01 | 9.60 | 13.66 |
| CaO | 8.43 | 7.91 | 9.60 | 7.54 | 11.12 | 10.02 |
| $Na_2O$ | 4.13 | 3.73 | 2.74 | 3.49 | 3.65 | 1.23 |
| $K_2O$ | 0.50 | 0.53 | 1.04 | 0.37 | 0.72 | 0.81 |
| $TiO_2$ | 1.69 | 3.10 | 1.82 | 1.02 | 0.44 | 0.71 |
| $P_2O_5$ | 0.16 | 0.33 | 0.16 | 0.12 | 0.06 | 0.07 |
| MnO | 0.18 | 0.20 | 0.17 | 0.19 | 0.12 | 0.17 |
| BaO | 0.03 | 0.02 | 0.05 | 0.01 | 0.04 | 0.03 |
| L.O.I. | 1.89 | 1.98 | 1.98 | 3.06 | 9.72 | 4.28 |
| TOTAL | 99.97 | 99.13 | 101.05 | 100.28 | 100.31 | 100.72 |
| ※S | 0.06 | 0.01 | 0.05 | 0.00 | 0.07 | 0.19 |
| Rb | 8 | 8 | 12 | 4 | 5 | 9 |
| Ba | 232 | 274 | 423 | 130 | 327 | 267 |
| Sr | 312 | 310 | 264 | 194 | 136 | 72 |
| La | 35 | 0 | 30 | 30 | 64 | 54 |
| Ce | 0 | 0 | 0 | 0 | 0 | 30 |
| Y | 23 | 56 | 24 | 40 | 11 | 16 |
| Th | 2 | 6 | 0 | 0 | 0 | 0 |
| Zr | 62 | 238 | 63 | 78 | 0 | 0 |
| Nb | 0 | 7 | 0 | 0 | 0 | 0 |
| Ti | 10120 | 18570 | 10900 | 6110 | 2640 | 4250 |
| Ni | 90 | 74 | 106 | 132 | 354 | 436 |
| Sc | 41 | 33 | 35 | 42 | 44 | 39 |
| V | 402 | 189 | 358 | 320 | 202 | 262 |
| Cr | 146 | 113 | 190 | 300 | 1000 | 1300 |
| Li | 9 | 6 | 36 | 27 | 12 | 39 |
| Ga | 19 | 26 | 23 | 16 | 11 | 16 |
| Ge | 3 | 5 | 2 | 5 | 0 | 0 |
| Cu | 175 | 146 | 146 | 134 | 33 | 330 |
| Pb | 0 | 3 | 0 | 0 | 0 | 0 |
| Zn | 80 | 118 | 102 | 65 | 41 | 64 |

TABLE XX. Trace element content of pyrites.

| No. | Location | V | Co | Ni | Mn |
|---|---|---|---|---|---|
| | | Parts per million | | | |
| East Darwin | | | | | |
| 41253 | Trench, north end of zone | | 79 | 12 | 5 |
| 41255 | " " " | | 44 | 9 | 7 |
| 41271 | Dillons No. 1 adit | | 28 | 6 | 7 |
| 41272 | " " | | 445 | 23 | 98 |
| 41273 | " " | 6.2 | 278 | 6 | 127 |
| 41274 | " " | | 214 | 15 | 36 |
| 41277 | Souters adit | | 321 | 15 | 114 |
| 41280 | " " | | 16 | 400 | 162 |
| 41282 | " " | | 334 | 18 | 217 |
| 41287 | Dillons No. 2 adit | | 569 | 12 | 10 |
| 41288 | " " | | 1232 | 28 | <3 |
| 41289 | Trench above Dillons No. 2 adit | | 16 | 22 | 8 |
| 41291 | Small un-named adit, centre of zone | 10.7 | 61 | 6 | 16 |
| 41292 | " " " " | | 48 | <6 | 10 |
| 41293 | " " " " | 1.9 | 135 | <6 | 8 |
| 41294 | " " " " | | 208 | 12 | 19 |
| 41296 | Trench near centre of zone | | 208 | 174 | <3 |
| 41297 | " " " | | 130 | <6 | 11 |
| 41298 | " " " | | 61 | 6 | 14 |
| 41299 | Pearce's adit | <1 | 66 | 32 | 17 |
| 41303 | " " | | 36 | 28 | 44 |
| Associated with magnetite mineralization | | | | | |
| 41182 | South end of Prince Darwin zone | | 513 | 922 | 4 |
| 41183 | " " " " | 5.4 | 949 | 246 | 3 |
| 41100 | Prince Darwin 11600N traverse | | 2150 | 89 | 6 |
| 41102 | " " " " | | 2150 | 92 | <3 |
| 41113 | Prince Darwin north end 7000E traverse | | 1501 | 227 | 11 |
| 41125 | Prince Darwin south adit | 2.3 | 1608 | 329 | 3 |
| 41125(2) | " " " | | 1608 | 227 | 5 |
| 41138 | Prince Darwin DDH-1 | | 801 | 352 | 47 |
| 41361 | Jukes Proprietary | | 2843 | 227 | 23 |
| 41354 | " " | | 13710 | 191 | 10 |
| In Darwin Granite | | | | | |
| 41167 | Near eastern margin on access road | | 482 | 17 | 56 |
| 41168 | " " " " " | | 1644 | 23 | 6 |
| 41168(2) | " " " " " | | 3580 | 125 | 8 |
| 41169 | " " " " " | | 1868 | 98 | 8 |
| 41141 | Large vein in creek, south Darwin Plateau | | 593 | 83 | <3 |
| 41103 | Prince Darwin 11600N traverse | | 2278 | 170 | 13 |
| 41104 | Prince Darwin 10400N traverse | | 949 | 49 | 17 |
| Miscellaneous | | | | | |
| 41206 | Adit in sericitic zone, north Mt. Darwin | | 40 | 18 | 71 |
| 41311 | Massive rhyolite near Conglomerate Peak | 1.5 | 2693 | 56 | 40 |

TABLE XX continued. Trace element contents of pyrites.

| No. | Location | V | Co | Ni | Mn |
|---|---|---|---|---|---|
| | | Parts per million | | | |
| Mount Lyell | | | | | |
| 41466 | Massive pyritic ore, West Lyell Opencut | | 1717 | 183 | 34 |
| 41467 | Vein, Cape Horn | | 160 | <6 | 17 |
| 19791 | Blow dump | | 272 | 62 | 46 |
| 101514 | Vein, West Lyell Opencut | | 106 | 92 | <3 |
| 101636 | Blow dump | | 24 | 9 | 16 |
| 101655 | Lyell Comstock | | <4 | <6 | 2155 |
| Other Deposits | | | | | |
| 100731 | Vein in sediments, Florentine Valley, Tasmania | 3.0 | 150 | 42 | <3 |
| 100732 | " " " " | 5.0 | 452 | 45 | 3 |
| 101839 | Monaska Mine, Japan | | 181 | 28 | <3 |
| 101837 | Besshi Mine, Japan | | 430 | 22 | 6 |
| 101830 | Ikadatsu Mine, Japan | | 482 | 66 | 31 |
| 101948 | Mount Morgan Sugarloaf | | 57 | <6 | 7 |
| 101794 | Silvermines, Eire | | 12 | 107 | 221 |
| 101809 | Avoca, Eire | | 74 | 9 | 101 |
| 101333 | Cobar, N.S.W. | | 192 | 25 | <3 |

TABLE XXI. Partial analyses of mineralized samples from East Darwin.

| | 41312 | 41313 | 41314 | 41315 | 41316 | 41317 | 41318 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 85.43 | 39.42 | 81.63 | 87.00 | 77.47 | 74.31 | 46.73 |
| $Al_2O_3$ | 5.13 | 3.73 | 5.49 | 6.29 | 5.03 | 10.91 | 4.24 |
| *$Fe_2O_3$ | 3.41 | 36.45 | 5.96 | 2.07 | 9.80 | 5.73 | 27.58 |
| $K_2O$ | 1.80 | 1.37 | 1.91 | 2.14 | 1.73 | 3.52 | 1.42 |
| CaO | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

| | 41319 | 41320 | 41321 | 41322 | 41323 | 41324 | 41325 |
|---|---|---|---|---|---|---|---|
| $SiO_2$ | 64.37 | 46.27 | 47.30 | 23.82 | 65.85 | 70.87 | 34.13 |
| $Al_2O_3$ | 10.02 | 3.03 | 3.18 | 2.24 | 13.77 | 11.78 | 1.70 |
| *$Fe_2O_3$ | 12.99 | 32.48 | 31.85 | 47.32 | 8.61 | 6.76 | 40.89 |
| $K_2O$ | 3.21 | 1.02 | 1.04 | 0.82 | 5.12 | 3.97 | 0.61 |
| CaO | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

| | 41326 | 41327 | 41328 | 41329 | 41330 | 41331 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 33.09 | 67.78 | 62.56 | 66.34 | 52.27 | 63.82 |
| $Al_2O_3$ | 2.35 | 6.62 | 7.33 | 6.38 | 4.43 | 5.23 |
| *$Fe_2O_3$ | 39.36 | 13.02 | 15.82 | 14.32 | 26.01 | 17.05 |
| $K_2O$ | 0.87 | 2.26 | 2.47 | 2.16 | 1.56 | 1.77 |
| CaO | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |

# APPENDIX II

## SAMPLING AND ANALYTICAL METHODS

## 1. Whole Rock Analysis

### a) Field Sampling

Most samples were taken using a sledge hammer, and as far as possible weathered material was excluded. Sample sizes varied from about one kilogram for very fine-grained unweathered material, to about 25 kg for a coarse-grained granite (41471).

### b) Sample Preparation

Where necessary samples were broken to manageable size with a hammer, then run through a jaw crusher with hardened jaws until all passed a No. 8 mesh B.S. sieve. After mixing, a split of 2 - 300 grammes was taken. This was ground in a mechanical agate mortar and pestle until reduced to about 44 mesh B.S.S., when a sub-sample of about 30 g was taken (see Kleeman, 1967). This was ground to -63 microns using a mechanical agate mortar and pestle.

This -63 micron powder was dried in an air oven at 110°C, and all determinations made on dry basis.

### c) Major Element Analysis

Four analytical methods were used for major element analysis:

I Gravimetric analysis - loss on ignition

II X-ray fluorescence analysis - Si, Al, Fe, Ca, K, P, S

III Optical emission spectroscopy - Ca, Mg, Mn, Ti, Ba

IV Atomic absorption spectroscopy - Na.

I Loss on ignition was determined by igniting about one gramme of dried powder in a muffle furnace at 900°C for three hours. The ignition was carried out in porcelain, vitrosil, or platinum crucibles. The samples were allowed to cool to about 400$^{o}$C in the furnace, then removed and cooled in a dessicator before weighing.

II and III  X.R.F. and O.E.S. analyses were carried out on the same sample. The analytical method used was devised by officers of B.H.P. Central Research Laboratories, Analytical Sciences Group. The following is a brief outline of the sample preparation procedure.

The following were successively weighed into a weighed 15 ml Pt-Au crucible:

2.000 ± 0.001 g fusion mixture (64% $Li_2B_4O_7$, 36% $La_2(B_4O_7)_3$)

dried rock powder (see below)

200 ± 3 mg $Li_2CO_3$ ("J.T. Baker Analysed", stored at 105$^{o}$C)

100 ± 3 mg $LiNO_3$ ("J.T. Baker Analysed", stored at 105$^{o}$C)

The weight of rock powder taken was varied so that after fusion the weight present was between 190 and 210 mg. Within this range corrections for the actual weight taken could be applied. The weight required could usually be estimated from the L.O.I. of the sample, unless it contained unusually high levels of Fe or S.

The contents of the crucible were thoroughly mixed with a Pt-Rh wire. Blank fusions (i.e. as above but omitting rock powder) were run concurrently. The lidded crucibles were placed in a muffle furnace at 980$^{o}$C for 10 minutes. On removal from the furnace the crucibles were allowed to cool, then weighed and the fused bead removed.

Graphite (1½ times the fused bead weight) was added to the bead. Both were placed in a 100 ml WC barrel of a Seibtechnik swing mill, and ground for 150 seconds. The powder was removed and pressed in a hydraulic press to a 2.54 cm diameter briquette under a load of 45 kN (10000 lb.f.) for 20 seconds. The sample number was scratched on the briquette which was then stored at 110°C.

In addition to samples for analysis, artificial calibration standards, and International Standard rocks were also prepared. Prior to each analytical procedure a fresh surface was prepared on each briquette by rubbing on fine silicon carbide paper, then on a clean tissue to remove dust.

Full details of the method used are recorded in internal publications of the B.H.P. Central Research Laboratories, Technology and Services Section.

X.R.F. operating conditions are shown in Table XXII.

Each run of ten samples contained a specially prepared glass sample which was used to monitor and correct variations in count rate between runs. At the sample dilution used (25:1) matrix corrections for major elements are negligible.

O.E.S. operating conditions are shown in Table XXIII. Although less precise than X.R.F. for some major elements (e.g. $SiO_2$, $Al_2O_3$, $Fe_2O_3$), it allowed an independent check on X.R.F. results for these elements. Calibration standards were interspersed with samples for analysis. At least two sparkings were carried out for each sample, with a third if the difference in counts was excessive. O.E.S. results were used exclusively for MgO, $TiO_2$, MnO, and high BaO levels, and were favoured for CaO.

IV Atomic Absorption Spectroscopy was used in the determination of sodium. In some cases 250 mg, and in others 500 mg of rock powder was used. The powder was placed in a 50 ml teflon beaker, wet with water, and concentrated hydrofluoric acid added (10 ml for 250 mg, 15 ml for 500 mg). The beakers were gently fumed on a sand bath to a volume of 3-5 ml, after which a further 10 ml of HF was added and the volume again reduced. When the beakers had cooled 2 ml conc. $HNO_3$ and 6 ml 70% $HClO_4$ were added and the beakers again heated. Evaporation was continued until fuming, then for a further 2 minutes. The sides of the beaker were washed down with 50% v/v $HClO_4$ while still hot. Evaporation was continued until salts began to separate, or the volume reached 2 ml, when 10 ml 20% v/v HCl, and 6 ml water were added and boiled for 2 minutes. This solution was cooled, and washed into a 50 ml graduated flask to which 3 ml 100 mg/ml $LaCl_3$ solution had been added. The solution was made up to volume with water, and was subsequently used for the determination of Cu and Li (see below). 2 ml of this solution, diluted to 100 ml was used for the Na determination.

Artificial standards were prepared with Al, Fe, and Ca content approximating a mean composition for many of the rocks being analysed.

d) Trace Element Analysis

Two analytical methods were used for trace element determinations - atomic adsorption spectroscopy for Li and Cu, and X-ray fluorescence spectroscopy for all others.

Sample preparation for A.A.S. analysis has already been outlined for the determination of sodium.

For X.R.F. determination of trace elements one gramme of dried rock powder was taken, 0.80 g $Li_2B_4O_7$ and 3.20 g graphite added. Milling and briquetting procedure was similar to that outlined for major elements, though much more exhaustive cleaning procedures were necessary. Artificial standards were prepared in similar fashion from specially prepared glasses containing known amounts of a large number of non-interfering trace elements. Varying the matrix composition allowed the effects of changes in matrix to be quantified. Special interference briquettes were prepared to evaluate spectral interference (e.g. Ti on V). This was achieved by determining the apparent content of e.g. V, in a sample containing Ti and no V. The V content of a given sample could then be determined by subtracting from the observed counts the contribution due to its Ti content.

Details of X.R.F. operating conditions for trace element determinations are shown in Table XXIV.

e) Accuracy and Precision

Extensive use was made of standard rocks to maintain a check on the accuracy of determinations. At various stages the following International Standard Rocks were used:

| | |
|---|---|
| U.S.G.S. | AGV-1, BCR-1, GSP-1, PCC-1, DTS-1, G-2 |
| U.S. | NBS-160, NBS-102 |
| C.A.A.S. | S-1, S-2 |
| French | GR, BR, GA, GH |
| British | BCS-269, 375, 376, 313, 267 |

Results of analyses of standard rocks are given in Tables XXV and XXVI. It must be remembered that these are independent determinations which do not rely on any previous analyses of these rocks, as only artificial calibration standards were used. These figures may be compared with published results (e.g. Abbey, 1970, 1972; Flanigan, 1969; Roubault, 1970; Blackburn *et al.*, 1971). In addition six separate determinations were carried out on BCR-1 (Table XXVII).

To check on possible errors arising from sample preparation procedures, two rocks were prepared as follows. After initial crushing five separate splits were taken, and the rest of the sample preparation procedure was followed for each split separately. The two samples used, 41507 and 41471, were a coarse spillite and a very coarse porphyritic granite respectively. At each stage in the sample preparation procedure they were alternated erratically to maximise any variations which might arise by cross-contamination, etc.. Each split was analysed separately, and five separate determinations were made for one of the splits. One other split was analysed in duplicate for major elements. No difference was detectable between the two groups of analyses, i.e. those taken from one split, and those taken from different splits. The results are shown in Table XXVIII, along with the means and standard deviations for the two groups. These give an indication of precision, though the deliberate attempt made to maximise undesirable effects will have resulted in the indicated precision being an extremely pessimistic estimate. Thus the relative deviations are in most cases greater than those found for the repeated determinations of BCR-1 (Table XXVII).

f) Intrumentation

I X.R.F.- Siemens SRS 1 with 10 sample changer

Kristalloflex IV generator

T-type counting electronics rack

Tabulator (register) automatic hardware programmed/controlled

Spectrometer cabinet air-conditioned to 25 ± 0.5°C

Detectors: Scintillation - Tl-doped NaI scintillation crystal

Photomultiplier HV = 1300 V.

Gas-flow proportional - 90% Ar/10% $CH_4$ at 16 psig., 3 l/hr. flow rate, 40 micron wire, 2 micron polypropylene window ("Makrofol"), HV = 1730 V.

Pulse height Analysis automatic through use of a Sine θ potentiometer, giving constant pulse amplitude with varying θ angle. Pre-set crystal potentiometers. Constant first order pulse amplitude 3.0 V., lower level 2.0 V. (i.e. channel width 2.0 V., upper level 4.0 V.)

Sample holders sintered carbon, irradiated sample area 23 mm diameter.

Collimators: fine 0.15° solid angle

coarse 0.4° solid angle

Vacuum

Rotation

| | | |
|---|---|---|
| Tubes: | AG Cr 61 | 2.6 kW maximum |
| | AG Mo 61 | 3.0 kW maximum |
| | AG W 61 | 3.0 kW maximum |

Read-out through ASR 35 teletype.

II O.E.S.- Jarell-Ash 65-100 Series 2 metre vacuum atomcounter

Entrance slit 25 microns

Dispersion 4.2 A° per millimetre

III A.A.S.- Varian-Techtron AA4 with digital read-out.

## 2. Partial Analyses

The partial analyses of pyritic rocks from East Darwin were carried out by means of the X.R.F. major element technique outlined previously. For the desired purpose it was not necessary that these results be of high precision, so the weight after fusion was allowed to fall outside the 190 to 210 mg range. Two of the samples were repeated in whole rock analysis. A comparison of the complete and partial analyses is shown below.

| Number | 41319 | | 41324 | |
|---|---|---|---|---|
| | complete | partial | complete | partial |
| $SiO_2$ | 67.72 | 64.4 | 70.83 | 70.9 |
| $Al_2O_3$ | 9.98 | 10.0 | 12.20 | 11.8 |
| $Fe_2O_3$ | 11.92 | 13.0 | 6.48 | 6.8 |
| $K_2O$ | 3.26 | 3.2 | 3.97 | 4.0 |

## 3. Trace Elements in Pyrite

The method of Loftus-Hills (1968) was used for the determination of Co, Ni, and Mn in pyrite. In brief, high purity (>95%) pyrite samples were obtained by a combination of froth flotation and heavy liquid (bromoform) separations. A one gramme sample of the pyrite was ignited for three hours in a muffle furnace at 900$^{\circ}$C to oxidise the sulphur. The resulting oxide was dissolved in concentrated hydrochloric acid, and the iron extracted by means of di-isopropyl ether. Determinations were made on the resulting solution diluted to standard volume.

A similar procedure was adopted for vanadium determinations, however much higher concentration factors were required (e.g. 10 g pyrite into 10 mls final solution).

Analysis in all cases was by atomic absorption spectroscopy, using an upgraded Varian-Techtron AA3 with chart recorder output. An air-acetylene flame was used for Co, Ni, and Mn, and a lean nitrous oxide-acetylene flame for V.

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TABLE XXII. X.R.F. Operating conditions, major elements.

| element | line | background (degrees) | crystal | counting time (secs) | collimator (degrees) |
|---|---|---|---|---|---|
| Si | K | - | PET | 200 | 0.4 |
| Al | K | - | PET | 200 | 0.4 |
| Fe | K | - | $LiF_{110}$ | 100 | 0.15 |
| Ca | K | - | PET | 100 | 0.15 |
| K | K | - | PET | 100 | 0.15 |
| P | K | 137.650 | PET | 200 | 0.4 |
| S | K | 107.690 | PET | 200 | 0.4 |

Tube - Cr 50 kV. 50 mA.
Flow counter (90% Ar/10% $CH_4$)
vacuum
rotation

TABLE XXIII. O.E.S. Operating conditions, major elements.

| element | line ($A^O$) | slit width (microns) |
|---|---|---|
| Si | 2516 | 75 |
| | 2881 | 75 |
| Al | 3961 | 50 |
| Fe | 2598 | 50 |
| | 2714 | 75 |
| Mg | 2790 | 50 |
| Ca | 3158 | 50 |
| Ti | 3242 | 50 |
| Mn | 2933 | 75 |
| P | 1782 | 75 |
| S | 1807 | 75 |
| Ba | 2335 | 75 |
| Cr | 2677 | 75 |
| Cu | 3274 | 50 |
| La | 3790 | 35 |

Preflush 5 seconds argon
Preburn 10 seconds
Spark 5.6 Amps.
Exposure 18-20 secs, controlled by internal standard (La)
Spark Gap 4 mm
Electrode graphite

TABLE XXIV. X.R.F. operating conditions, Trace Elements.

| element | line | background (degrees) | tube | crystal | counting time (secs) | counter | l.l.d.* |
|---|---|---|---|---|---|---|---|
| Ce | L | 125.520 | Cr | Ge | 200 | DZ | 15.4 |
| Ti | L | 89.100 | Cr | $LiF_{100}$ | 100 | DZ | 1.3 |
| Ba | L | 89.100 | Cr | $LiF_{100}$ | 100 | DZ | 4.1 |
| Sc | K | 95.650 | Cr | $LiF_{100}$ | 100 | DZ | 1.1 |
| La | L | 142.300 | Cr | Ge | 200 | DZ | 12.1 |
| Zr | K | 32.920 | Mo | $LiF_{110}$ | 100 | SZ | 4.5 |
| Y | K | 35.180 | Mo | $LiF_{110}$ | 100 | SZ | 1.9 |
| Sr | K | 35.180 | Mo | $LiF_{110}$ | 100 | SZ | 2.8 |
| Rb | K | 35.180 | Mo | $LiF_{110}$ | 100 | SZ | 2.0 |
| Th | L | 41.500 | Mo | $LiF_{110}$ | 100 | SZ | 5.9 |
| Pb | L | 41.500 | Mo | $LiF_{110}$ | 100 | SZ | 6.1 |
| Ge | K | 50.700 | Mo | $LiF_{110}$ | 100 | SZ | 3.6 |
| Ga | K | 57.000 | Mo | $LiF_{110}$ | 100 | SZ | 3.7 |
| Zn | K | 57.000 | Mo | $LiF_{110}$ | 100 | SZ | 4.3 |
| Nb | K | 32.880 | W | $LiF_{110}$ | 200 | SZ | 2.7 |
| Ni | K | 70.450 | W | $LiF_{110}$ | 200 | DZ | 2.2 |
| Cr | K | 105.300 | W | $LiF_{110}$ | 200 | DZ | 3.8 |
| V | K | 129.750 | W | $LiF_{110}$ | 200 | DZ | 2.5 |
| Ti | K | 129.750 | W | $LiF_{110}$ | 40 | DZ | |

all 50 kV., 50 mA., rotation, vacuum, collimator 0.15$^{\circ}$, Ti filter

counter SZ = scintillation counter
DZ = flow counter

* calculated lower limit of detection in parts per million

$$\text{l.l.d.} = \frac{3}{m}\sqrt{\frac{R_b}{T_b}}$$

m = counts/second/p.p.m.

$R_b$ = uncorrected background counts

$T_b$ = counting time (secs.)

These are approximate only as count rate varies with matrix composition and interfering elements.

TABLE XXV. Results of analyses of International Standard rocks - major and minor elements.

| | AGV-1 | | GSP-1 | PCC-1 | DTS-1 | G-2 | S-1 | | S-2 | GR | BR | GA | GH | BCS 269 | BCS 375 | BCS 376 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2* | 1 | 1 | 1 | 1 | 1 | 2* | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| $SiO_2$ | 60.55 | 60.15 | 67.38 | 41.81 | 39.76 | 69.75 | 58.70 | 58.34 | 59.96 | 65.26 | 39.06 | 69.18 | 74.26 | 56.30 | 65.31 | 66.57 |
| $Al_2O_3$ | 17.95 | 17.68 | 15.42 | 0.48 | 0.06 | 15.73 | 9.28 | 8.84 | 12.06 | 14.65 | 9.81 | 14.77 | 12.76 | 33.94 | 19.30 | 17.68 |
| $Fe_2O_3$ | 6.77 | 6.81 | 4.38 | 8.30 | 8.65 | 2.74 | 8.37 | 8.29 | 6.11 | 4.00 | 12.57 | 2.78 | 1.40 | 3.45 | 0.16 | 0.07 |
| MgO | 1.51 | 1.54 | 0.96 | | | 0.74 | | 3.91 | 2.68 | 2.28 | | | 0.08 | 0.90 | 0.01 | 0.00 |
| CaO | 4.96 | | 2.04 | 0.52 | 0.11 | 1.91 | 10.00 | | 7.72 | 2.33 | 13.60 | 2.38 | | 0.23 | 0.80 | 0.42 |
| $Na_2O$ | 4.17 | | 2.86 | | 0.02 | 4.01 | 3.60 | | 4.32 | | 3.12 | 3.47 | 3.87 | 0.43 | 9.99 | |
| $K_2O$ | 3.00 | 2.98 | 5.58 | 0.00 | 0.00 | 4.52 | 2.64 | | 4.48 | 4.48 | 1.44 | 4.03 | 4.69 | 2.57 | 0.74 | 11.13 |
| $TiO_2$ | 1.05 | 1.01 | 0.61 | 0.00 | 0.00 | 0.47 | | 0.45 | 0.14 | 0.59 | | 0.34 | 0.08 | 1.40 | 0.38 | 0.00 |
| $P_2O_5$ | 0.48 | | 0.27 | 0.02 | 0.01 | 0.14 | 0.15 | | 0.39 | 0.27 | 1.03 | 0.11 | 0.01 | 0.08 | 0.04 | 0.01 |
| MnO | 0.09 | 0.02 | 0.01 | 0.15 | 0.18 | 0.01 | | 0.36 | 0.31 | 0.02 | 0.20 | 0.07 | 0.01 | 0.05 | 0.03 | 0.00 |
| S | 0.04 | | | 0.04 | 0.05 | | | | 0.03 | | | 0.00 | | 0.00 | 0.06 | 0.04 |
| BaO | 0.13 | 0.12 | 0.13 | 0.00 | 0.00 | 0.20 | | 0.03 | 0.05 | 0.10 | 0.12 | 0.08 | 0.00 | 0.06 | 0.01 | 0.02 |

Repeat determination on the same briquette, approximately one month after the initial determination.

TABLE XXVI. Results of analyses of International Standard rocks - trace elements.

| | BCR-1 | AGV-1 | GSP-1 | G-2 | GR | BR | GA | GH | S-1 | S-2 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ba | 710 | | | | | | 787 | 33 | 277 | |
| Ce | | | 320 | | 48 | | 53 | | 372 | |
| Cr | 13 | | 15 | 17 | 97 | | 28 | | 43 | |
| Ga | 24 | 23 | 22 | 23 | 22 | 22 | 15 | 15 | 27 | |
| Ge | 2 | 1 | 4 | 0 | 5 | 6 | 3 | 6 | 3 | |
| Nb | 14 | 14 | 25 | 11 | 19 | | 14 | | | |
| Ni | 18 | 16 | 6 | 6 | 52 | c.240 | 6 | 4 | 34 | 5 |
| Pb | 10 | 32 | 51 | 34 | 31 | 11 | 30 | 46 | | |
| Rb | 47 | 70 | 283 | 192 | 204 | 57 | 190 | 445 | 190 | 248 |
| Sc | 29 | 13 | 7 | 3 | 7 | 29 | 7 | 1 | 13.5 | 9 |
| Sr | 326 | 688 | 246 | 517 | | >1000 | 358 | | 205 | 272 |
| Th | 7 | 4 | 126 | 36 | 53 | 22 | 23 | 109 | | |
| Ti | | | | | | | | 503 | | |
| V | 384 | 121 | 48 | 33 | 66 | 234 | 40 | 16 | 90 | |
| Y | 39 | 18 | 39 | 21 | 24 | 31 | 30 | 102 | | |
| Zn | 120 | 75 | 88 | | 50 | 165 | | 83 | 230 | 221 |
| Zr | 172 | 221 | | | 326 | 244 | 164 | | | |

TABLE XXVII. Duplicate analyses of BCR-1.

| | 1 | 2 | 3 | 4 | 5 | 6 | mean | standard deviation | relative deviation |
|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 54.41 | 55.02 | 54.82 | 54.26 | 55.44 | 53.87 | 54.64 | 0.52 | 0.9 |
| $Al_2O_3$ | 13.51 | 13.50 | 13.61 | 13.70 | 13.30 | 13.04 | 13.44 | 0.22 | 1.6 |
| *$Fe_2O_3$ | 13.22 | 13.02 | 13.37 | 13.13 | 12.94 | 13.26 | 13.16 | 0.15 | 1.1 |
| MgO | 3.46 | 3.49 | 3.42 | 3.37 | 3.46 | 3.46 | 3.44 | 0.04 | 1.1 |
| CaO | 6.75 | 6.94 | 6.83 | 6.81 | 6.97 | 6.85 | 6.86 | 0.075 | 1.1 |
| $Na_2O$ | 3.25 | | | | | | | | |
| $K_2O$ | 1.75 | 1.74 | 1.74 | 1.71 | 1.77 | 1.73 | 1.74 | 0.02 | 1.0 |
| $TiO_2$ | 2.30 | 2.34 | | | 2.36 | 2.30 | 2.33 | 0.03 | 1.1 |
| $P_2O_5$ | 0.35 | 0.38 | 0.35 | 0.33 | 0.33 | 0.36 | 0.35 | 0.017 | 4.9 |
| MnO | 0.18 | 0.17 | 0.17 | 0.16 | 0.17 | 0.17 | 0.17 | 0.006 | 3.2 |
| ※S | 0.09 | 0.02 | 0.05 | 0.02 | 0.02 | 0.01 | 0.035 | 0.028 | 80.0 |
| BaO | 0.07 | 0.08 | 0.07 | 0.07 | 0.08 | 0.08 | 0.075 | 0.006 | 7.3 |

*$Fe_2O_3$ = Total iron expressed as $Fe_2O_3$
※S = Total sulphur expressed as S

$$\text{Relative deviation} = \frac{\text{standard deviation} \times 100}{\text{mean}}$$

TABLE XXVIII.

Analyses of Rock Number 41507.

| | | | | | | | | | | | within splits† | | between splits † | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S1 | S1A | S1A2 | S1B | S1C | S1D | S1E | S1F | S1G | S1H | mean of 5 | standard deviation | mean of 5 | standard deviation |
| $SiO_2$ | 47.08 | 47.71 | 47.80 | 47.09 | 47.29 | 47.36 | 47.75 | 47.38 | 45.33 | 47.34 | 46.91 | 0.85 | 47.31 | 0.23 |
| $Al_2O_3$ | 13.51 | 13.58 | 13.74 | 13.64 | 13.41 | 13.72 | 13.66 | 13.60 | 13.16 | 13.61 | 13.51 | 0.18 | 13.57 | 0.11 |
| *$Fe_2O_3$ | 14.21 | 14.14 | 14.17 | 14.22 | 14.28 | 14.13 | 14.04 | 14.09 | 14.11 | 14.07 | 14.10 | 0.06 | 14.20 | 0.06 |
| MgO | 6.78 | 6.43 | 6.65 | 6.82 | 6.97 | 6.65 | 6.64 | 6.57 | 6.42 | 6.67 | 6.62 | 0.12 | 6.73 | 0.18 |
| CaO | 8.92 | 8.54 | 8.87 | 8.93 | 8.82 | 8.70 | 8.30 | 8.12 | 8.12 | 8.45 | 8.38 | 0.30 | 8.78 | 0.15 |
| $Na_2O$ | 3.45 | 3.40 | | 3.26 | 3.47 | 3.42 | | | | | | | 3.40 | 0.07 |
| $K_2O$ | 1.11 | 1.13 | 1.13 | 1.12 | 1.10 | 1.11 | 1.19 | 1.19 | 1.18 | 1.18 | 1.17 | 0.03 | 1.11 | 0.01 |
| $TiO_2$ | 2.41 | 2.33 | 2.30 | 2.30 | 2.32 | 2.36 | 2.37 | 2.26 | 2.35 | 2.35 | 2.35 | 0.05 | 2.34 | 0.04 |
| $P_2O_5$ | 0.22 | 0.23 | 0.21 | 0.20 | 0.19 | 0.20 | 0.20 | 0.21 | 0.21 | 0.20 | 0.21 | 0.01 | 0.21 | 0.01 |
| MnO | 0.23 | 0.21 | 0.20 | 0.20 | 0.21 | 0.22 | 0.20 | 0.19 | 0.21 | 0.20 | 0.21 | 0.01 | 0.21 | 0.01 |
| ⁑S | 0.06 | 0.02 | 0.05 | 0.12 | 0.03 | 0.03 | 0.02 | 0.05 | 0.05 | 0.02 | 0.04 | 0.02 | 0.05 | 0.04 |
| BaO | 0.03 | 0.01 | 0.02 | 0.20 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.004 | | |
| L.O.I. | 2.33 | 2.40 | | 2.43 | 2.54 | 2.51 | | | | | | | 2.44 | 0.08 |
| | | | | | | | | | | | | | | |
| Rb | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | - |
| Ba | 180 | 190 | | 178 | 174 | 187 | 178 | 182 | 188 | 178 | 181 | 4 | 182 | 6 |
| Sr | 141 | 140 | | 137 | 142 | 141 | 130 | 138 | 138 | 140 | 137 | 4 | 140 | 2 |
| Cr | 198 | | | | | | | | | | | | | |
| Ni | 81 | 88 | | 88 | 84 | 71 | 88 | 82 | 78 | 78 | 81 | 4 | 82 | 6 |
| Ti | 14440 | 13780 | | 13780 | 13900 | 14140 | 14200 | 13540 | 14080 | 14080 | 14068 | 295 | 14008 | 253 |
| V | 397 | 397 | | 411 | 399 | 401 | 400 | 393 | 390 | 397 | 395 | 3 | 401 | 5 |
| Y | 31 | 32 | | 29 | 31 | 32 | 31 | 30 | 31 | 30 | 31 | 0.05 | 31 | 1 |
| Sc | 33 | 32 | | 34 | 32 | 32 | 33 | 34 | 34 | 32 | 33 | 1 | 33 | 1 |
| Nb | 6 | 0 | | 4 | 0 | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2.5 |
| Zr | 95 | 126 | | 85 | 98 | 89 | 96 | 85 | 89 | 88 | 91 | 4 | 99 | 14 |
| Th | 6 | 11 | | 5 | 5 | 3 | 12 | 9 | 11 | 7 | 9 | 2 | 6 | 3 |
| Li | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | - |
| Cu | 372 | 402 | | 372 | 387 | 384 | | | | | - | - | 283 | 11 |
| Pb | 12 | 6 | | 3 | 9 | 3 | 8 | 8 | 9 | 3 | 8 | 3 | 7 | 3 |
| Zn | 79 | 72 | | 71 | 84 | 72 | 70 | 70 | 75 | 75 | 74 | 3 | 76 | 5 |

*$Fe_2O_3$ = Total iron expressed as $Fe_2O_3$. ⁑S = Total sulphur expressed as S.

†S1, S1A, S1B, S1C, S1D are analyses of separate splits, the mean and SD for which are shown as "between splits". S1E, S1F, S1G, S1H are repeat determinations of S1, the mean and SD for which are shown as "within splits". S1A2 is a repeat determination of S1A, and is not included in either mean.

cont'd. over

TABLE XXVIII (cont'd.)

Analyses of Rock Number 41471.

| | S66 | S66A | S66A2 | S66B | S66C | S66D | S66E | S66F | S66G | S66H | within splits † mean of 5 | within splits † standard deviation | between splits † mean of 5 | between splits † standard deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SiO_2$ | 72.81 | 73.04 | 72.03 | 72.72 | 72.34 | 71.77 | 72.61 | 71.01 | 73.54 | 72.07 | 72.40 | 0.84 | 72.54 | 0.44 |
| $Al_2O_3$ | 13.34 | 13.11 | 13.33 | 12.95 | 12.98 | 13.75 | 13.55 | 12.83 | 13.08 | 13.34 | 13.23 | 0.25 | 13.23 | 0.30 |
| *$Fe_2O_3$ | 3.11 | 3.24 | 3.12 | 3.13 | 3.24 | 3.23 | 3.27 | 3.25 | 3.23 | 3.29 | 3.23 | 0.06 | 3.19 | 0.06 |
| MgO | 0.65 | 0.66 | 0.68 | 0.66 | 0.70 | 0.66 | 0.64 | 0.64 | 0.64 | 0.67 | 0.65 | 0.01 | 0.67 | 0.02 |
| CaO | 1.30 | 1.28 | 1.30 | 1.31 | 1.33 | 1.32 | 1.34 | 1.33 | 1.32 | 1.35 | 1.33 | 0.02 | 1.31 | 0.02 |
| $Na_2O$ | 2.39 | 2.33 | | 2.46 | 2.39 | 2.36 | | | | | | | 2.39 | 0.04 |
| $K_2O$ | 5.11 | 5.09 | 5.13 | 5.12 | 5.08 | 5.36 | 5.23 | 5.12 | 5.14 | 5.22 | 5.16 | 0.05 | 5.15 | 0.10 |
| $TiO_2$ | 0.42 | 0.44 | 0.44 | 0.44 | 0.45 | 0.46 | 0.42 | 0.42 | 0.42 | 0.41 | 0.42 | 0.004 | 0.44 | 0.01 |
| $P_2O_5$ | 0.06 | 0.09 | 0.08 | 0.06 | 0.09 | 0.08 | 0.09 | 0.09 | 0.10 | 0.07 | 0.08 | 0.01 | 0.08 | 0.01 |
| MnO | 0.05 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.07 | 0.08 | 0.06 | 0.06 | 0.01 | 0.06 | 0.004 |
| ※S | 0.06 | 0.00 | 0.07 | 0.03 | 0.03 | 0.04 | 0.02 | 0.02 | 0.06 | 0.03 | 0.04 | 0.02 | 0.03 | 0.02 |
| BaO | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | 0.12 | | | 0.12 | - |
| L.O.I. | 0.92 | 0.92 | | 0.90 | 0.95 | 1.00 | | | | | | | 0.94 | 0.03 |
| | | | | | | | | | | | | | | |
| Rb | 213 | 218 | | 212 | 214 | 216 | 215 | 216 | 210 | 212 | 213 | 2 | 215 | 2 |
| Ba | 1075 | 1075 | | 1075 | 1075 | 1075 | 1075 | 1075 | 1075 | 1075 | 1075 | - | 1075 | - |
| Sr | 141 | 138 | | 139 | 140 | 140 | 140 | 141 | 138 | 141 | 140 | 1 | 140 | 1 |
| Cr | 40 | 40 | | 47 | 42 | 37 | 37 | 43 | 41 | 43 | 41 | 2 | 41 | 3 |
| Ni | 10 | 21 | | 15 | 15 | 16 | 17 | 14 | 15 | 10 | 13 | 3 | 15 | 3 |
| Ti | 2520 | 2640 | | 2640 | 2700 | 2755 | 2520 | 2520 | 2520 | 2460 | 2508 | 24 | 2651 | 78 |
| V | 57 | 56 | | 56 | 55 | 55 | 60 | 58 | 56 | 58 | 58 | 1 | 56 | 1 |
| Y | 39 | 39 | | 40 | 40 | 39 | 41 | 37 | 39 | 41 | 39 | 1 | 39 | 0.5 |
| Sc | 7 | 7 | | 7 | 7 | 7 | 6 | 7 | 7 | 7 | 7 | 0.4 | 7 | - |
| Nb | 9 | 7 | | 6 | 8 | 6 | 7 | 8 | 5 | 9 | 8 | 1.5 | 7 | 1 |
| Zr | 303 | 296 | | 344 | 344 | 326 | 296 | 308 | 307 | 308 | 304 | 5 | 323 | 20 |
| Th | 41 | 45 | | 41 | 37 | 39 | 40 | 34 | 38 | 38 | 38 | 2 | 41 | 3 |
| Li | 0 | 0 | | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | - |
| Cu | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | - |
| Pb | 20 | 25 | | 18 | 21 | 18 | 24 | 22 | 20 | 15 | 20 | 3 | 20 | 3 |
| Zn | 0 | 0 | | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | - | 2 | 2 |

*$Fe_2O_3$ = Total iron expressed as $Fe_2O_3$. ※S = Total sulphur expressed as S.

† S66, S66A, S66B, S66C, S66D are analyses of separate splits, the mean and SD for which are shown as "between splits". S66E, S66F, S66G, S66H are repeat determinations of S66, the mean and SD for which are shown as "within splits". S66A2 is a repeat determination of S66A, and is not included in either mean.

# APPENDIX III

## STATISTICAL TREATMENT OF DATA

Four methods of statistical analysis were used on the whole rock analytical data obtained in this study.

I R-mode Factor Analysis

II Hierarchical Grouping

III Stepwise Discriminant Analysis

IV Discriminant Analysis

### Factor Analysis and Hierarchical Grouping

The R-mode Factor Analysis and Hierarchical Grouping were carried out by Mr. J. Knight on the Hydro-University Computing Centre Elliott 503 computer at the University of Tasmania. The following notes were prepared by Mr. Knight.

"A. DATA PREPARATION

Data consisted of major and minor constituent, and trace element abundances for 148 rock samples (13 majors and minors, 20 traces).

Essentially the same data format is required for both programs used, the only difference being that for U2222 (H Group), a number is added at the end of the data tape, specifying the maximum number of groups for which individual listing of the samples in each group is output.

Limitations 1) STORAGE - U2222 (H Group). A maximum of 127 samples (and variables) may be grouped hierarchically.

U1064 7RV (Factor Analysis). The maximum number of samples m, and variables n, are specified by the equations,

$$710 \geq 112 + m + 4n$$

$$16268 \geq 225 + 2mn + 2n^2 + \frac{n\ (n + 1)}{2}.$$

2) FORMAT - the sample names may include letters and numbers but must not exceed 5 characters.

- the variable names must not exceed 5 characters, and if possible should be made of 5 characters exactly (including spaces) so that they are placed directly above their respective columns in the print out.

3) DUMMY VALUES - U1064 7RV - the data matrix need not be complete for factor analysis. Dummy values of value $-10^{10}$ are inserted where data is missing.

- U2222 - the data matrix must be complete.

4) LOGNORMAL DISTRIBUTIONS - if the data is to be lognormalized then the initial data matrix must of course contain no zero values.

B. SEQUENCE OF ANALYSIS

m = no. of samples

| | | | m |
|---|---|---|---|
| 1. | R-mode factor analysis | - majors and minors | 148 |
| | | - traces | 148 |
| 2. | Hierarchical grouping | - majors and minors | 104 |
| | | - traces | 104 |
| | | - majors and minors | 44 |
| | | - traces | 44 |
| | | - factor scores (traces) | 80 |

C. PROGRAMS AND METHODS

1. R-MODE FACTOR ANALYSIS - U1064 7RV:- used to determine relationships between, and relative importance of, the variables measured. The steps in this analysis are:

a) set up data matrix

b) compute matrix $\overline{R}$, the sample correlation matrix

c) compute eigenvalues and find the number of "driving" factors

d) compute initial factor matrix $\overline{A}$ for the number of factors found in c).

e) compute 'rotated factor matrix' B = AP (where P is an orthogonal matrix) and assign substantive interpretations to the factors (see Krumbein and Graybill, 1965, page 375).

Program Options

a) The number of factors dealt with following calculation of the eigenvalues is controlled by specifying (using keys) a cutoff value for eigenvalues to be considered.

b) To cater for lognormally distributed data, as in the case of the trace elements, the data can be initially transformed to log base ten; these values are displayed at the beginning of the print out.

2. HIERARCHICAL GROUPING. U2222 H Group (see Veldman, 1967, p.308).

This program, translated by N. Chick from FORTRAN, clusters samples into successively fewer groups on the basis of similarity of profiles (with respect to variable scores). This allows construction of a dendrogram illustrating the hierarchical grouping of the samples. As the number of groups decreases, the error function, representing the degree of difference between two groups being combined, increases.

Program Options

If the sets of variable scores are not standardized then, using keys, this procedure can be optioned into the program.

EDIT U2222 - for true data

Since the trace element scores are lognormally distributed, the program was edited when using these data, to convert them to log base 10, before standardization. This is done so that the larger differences between larger values in the raw data, do not contribute more heavily to the error function than the differences in smaller values.

3. HIERARCHICAL GROUPING USING FACTOR SCORES

A discriminant function was sought to allow classification of future samples into groups defined by the cluster analysis. No existing program could be immediately used for the number of samples required. Therefore, the following method of simply defining a discriminative function (not necessarily the optimum function), was attempted.

Using as data factor scores derived from R-mode factor analysis of the trace element data for the first 80 samples (Mount Read Volcanics) hierarchical grouping was performed. If such grouping proved significant then a discriminant function, based on the factors used, could be calculated. It would have the form

$$F = a \log A + b \log B + c \log C + \ldots\ldots$$

where a, b, c, .... are constants and A, B, C, ..... trace elements abundances (values in ppm).

Factors 1, 2 and 6 were considered to be geologically significant, and likely to lead to significant grouping. Together they accounted for 50% of the total variance."

Results of R-mode Factor Analysis

The computer tapes have been filed in the Department of Geology, University of Tasmania. The rotated varimax factor score matrix and variance from varimax factors for major and minor elements (assumed normally distributed) for 148 analyses are shown in Table XXXI. The same information for trace elements (assumed lognormally distributed) is shown in Table XXXII.

Results of Hierarchical Grouping

The results of Hierarchical Grouping analysis are shown as dendrograms in Figures I to V.

Discriminant Analysis

Discriminant analysis of the analytical data was carried out by Mr. R. Turner, Geologist Data Processing, through the courtesy of Mr. D.G. Moye, Director of Exploration, and Dr. E.D. Bumstead, Chief Geochemist, the Broken Hill Proprietary Co. Ltd.. The computer used was a C.D.C. CYBER 74 operated by Control Data Australia in B.H.P. House, Melbourne.

The data supplied was divided into four groups, designated

GROUP A, consisting of Andrew and Clark Volcanics and their correlates

GROUP B1, consisting of unmineralized Intercolonial Volcanics

GROUP B2, consisting of mineralized or closely associated Intercolonial Volcanics

GROUP C, consisting of rocks of doubtful affiliations.

Elements considered here were $SiO_2$, $Al_2O_3$, $Fe_2O_3$, CaO, $Na_2O$, MgO, $K_2O$, Ti, Ni, Rb, Ba, Pb, Zr, Y, Sr, Cr, Sc, V, Nb, Li. Specimen numbers of rocks allocated to each group are shown in Table XXX. Zero values were not permissible for these programs, so 0.01% was inserted in place of zero for elements shown in oxide form, and 1 p.p.m. for those shown in the elemental form.

The object of the exercise was to obtain discriminant functions to distinguish between Group A, and Groups B1 and B2 combined, and between Group B1 and Group B2, and to classify the analyses in Group C into A, B1, or B2. The discriminant functions obtained for Groups A and (B1 + B2) are shown in Table 9 in Section 5.4vi. The results for Groups B1 and B2 are regarded as inconclusive and so are omitted from the main body of the text. The discriminant functions obtained are shown in Table XXIX.

Stepwise Discriminant Analysis was carried out for two groups, initially A and (B1 + B2), then B1 and B2. Any sample which misclassified was put into the other group, and the procedure repeated until no further misclassifications occurred. From this was obtained the "ten best" elements for each discrimination. Determination of the discriminant function by Discriminant Analysis for the two groups used the groups reduced by those samples which had misclassified in Stepwise Discriminant Analysis. In determining a discriminant function for Groups A and (B1 + B2), the "ten best" in common between those determined by stepwise analysis for A and (B1 + B2), and B1 and B2 were tested. The "ten best" from stepwise analysis of B1 and B2 were also tested. Similarly, in discriminant analysis of Groups B1 and B2 the "ten best" in common, and the "ten best" from stepwise analysis of A and (B1 + B2) were tested.

The following notes on the computation were provided by Mr. Turner.

"1. The sample size of each of the three groups is not sufficient particularly when noting the lack of homogeneity of samples within the groups. Also in the initial grouping of A and B2 there are fewer samples than variables.

2. The groups as defined were mixed and samples

belonging to another group were removed where necessary.

3. Different elements were used in the classification of Group A from Group (B1 + B2) and Group B1 from Group B2. The stepwise discriminant program includes each element in order of importance. The most important for each grouping are as follows:

A/(B1 + B2) $Al_2O_3$, $Na_2O$, Li, Cr, Zr, Ni, CaO, $SiO_2$, $Fe_2O_3$,

B1/B2 Zr, V, Pb, Cr, $SiO_2$, CaO, $Na_2O$, Ti.

4. Coefficients were calculated for groups of elements in order of their importance to the tenth element, and also for the following elements in an attempt to select the minimum number required to achieve discrimination for both divisions - Zr, $Na_2O$, CaO, $SiO_2$, Cr, Pb, $Fe_2O_3$, Li. The results of the discrimination using common elements was not as effective as hoped, but this work cannot be discounted as the characteristics of the populations are not reliably defined due to the lack of samples.

5. Samples from Group C were classified using the stepwise program so that the relative positions of these samples could be seen with respect to the Groups, A, B1, and B2."

The two programs used were from "Biomedical Computer Programme Manual", 1973 edition, published by University of California Press.

REFERENCES

KRUMBEIN, W.C., and GRAYBILL, F.A., 1965: *An introduction to statistical models in geology.* McGraw-Hill, New York.

VELDMAN, D.J., 1967: *Fortran Programming for the behavioral sciences.* Holt, Rinehart and Winston, New York, 406pp.

TABLE XXIX. Discriminant Functions for distinguishing mineralized or associated, and unmineralized Intercolonial Volcanics.

**Function 1**
16 Variables

| Variable | Coefficient |
|---|---|
| $SiO_2$ | -.07680 |
| $Al_2O_3$ | -.05299 |
| *$Fe_2O_3$ | -.06439 |
| CaO | .10365 |
| $Na_2O$ | .01857 |
| MgO | -.12958 |
| Ti | -.00017 |
| Ni | .00362 |
| Rb | -.00076 |
| Ba | -.00003 |
| Pb | -.00019 |
| Zr | .00363 |
| Sr | .00037 |
| Cr | .00769 |
| V | -.00684 |
| Li | .00024 |

$D_o$ between -6.23356 and -6.38536

**Function 2**
10 Variables

| Variable | Coefficient |
|---|---|
| Zr | .00206 |
| Cr | .00994 |
| $Na_2O$ | .06185 |
| $SiO_2$ | -.01488 |
| CaO | .23311 |
| Pb | -.00009 |
| Li | .00154 |
| $Al_2O_3$ | -.00887 |
| $Fe_2O_3$ | -.00376 |
| V | -.00701 |

$D_o$ between -.67658 and -.78455

IF $D > D_o$ then unmineralized

IF $D < D_o$ then mineralized or closely associated

*$Fe_2O_3$ = total iron expressed as $Fe_2O_3$.

When evaluating the discriminant function use percent oxide for elements listed in oxide form, and parts per million elsewhere.

NOTE: Function 2 was not completely effective in separating the two groups and two analyses overlapped within the range indicated for $D_o$. Three analyses misclassified in the mineralized group (Group B2) suggesting that they might be better regarded as belonging to Group B1.

TABLE XXX. Allocation of rock analyses to groups for Discriminant Analysis.

| Group A | Group B1 | Group B2 | Group C |
|---|---|---|---|
| 41151 | 41092 | 41094 | 37887 |
| 41186 | 41134 | 41117 | 37891 |
| 41193 | 41142 | 41319 | 41174 |
| 41194 | 41233 | 41323 | 41372 |
| 41239 | 41263 | 41377 | 41373 |
| 41247 | 41376 | 41381 | 41374 |
| 41379 | 41378 | 41382 | 41375 |
| 41380 | 41383 | 41388 | 41417 |
| 41386 | 41384 | 41389 | 41418 |
| 41387 | 41385 | 41390 | 41457 |
| 41392 | 41391 | 41435 | 41468 |
| 41419 | 41404 | 41436 | 41469 |
| 41420 | 41406 | 41437 | 41470 |
| 41421 | 41408 | 41438 | 41471 |
| 41423 | 41412 | 41439 | 41472 |
| 41427 | 41414 | 41440 | 41473 |
| 41429 | 41415 | 41441 | 41475 |
| 41430 | 41446 | 41442 | 41477 |
| 41432 | 41450 | 41443 | 41479 |
| 41434 | 41452 | 41444 | 41480 |
| 41462 | 41453 | 41445 | 41481 |
| (total 21) | 41454 | 41449 | 41482 |
| | 41456 | 41455 | 41483 |
| | (total 23) | 41465 | 41484 |
| | | (total 24) | 41485 |
| | | | 41489 |
| | | | 41509 |
| | | | 41511 |
| | | | 41514 |
| | | | 41525 |
| | | | 41526 |
| | | | 41527 |
| | | | 41534 |
| | | | 41535 |
| | | | 41536 |
| | | | (total 35) |

TABLE XXXI. Factor Analysis of major and minor elements (assumed normally distributed) for 148 analyses.

Rotated Varimax Factor Score Matrix

| Factor | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| $SiO_2$ | 0.130577 | -0.150805 | 0.011391 | -0.009267 | 0.048915 | -0.062988 |
| $Al_2O_3$ | 0.019357 | 1.200859 | -0.036642 | 0.145170 | 0.206980 | -0.102723 |
| $Fe_2O_3$ | 0.137034 | -0.028122 | 0.002532 | -0.148430 | 0.083674 | 0.023375 |
| MgO | 0.340613 | 0.142218 | -0.019294 | 0.177366 | 0.343009 | 0.141809 |
| CaO | -1.513109 | -0.039424 | 0.003066 | 0.057354 | 0.109363 | 0.020848 |
| $Na_2O$ | 0.163970 | -0.242487 | -0.081589 | 0.048447 | -0.282455 | -0.065305 |
| $K_2O$ | -0.116254 | -0.194636 | 0.193390 | -0.007257 | -0.230620 | -0.022230 |
| $TiO_2$ | 0.500883 | -0.159145 | -0.009024 | -0.004807 | -0.098415 | 0.065475 |
| $P_2O_5$ | 0.146372 | -0.207447 | 0.081683 | -0.030770 | -0.022859 | 0.239451 |
| MnO | 0.031487 | 0.086944 | -0.036486 | 0.029136 | 0.133619 | -1.245064 |
| S | -0.090927 | 0.154026 | 0.010111 | 1.158519 | 0.303059 | -0.031562 |
| BaO | 0.004018 | 0.036987 | -1.092541 | -0.010312 | 0.004518 | -0.044991 |
| L.O.I. | 0.122755 | -0.171896 | 0.003642 | -0.237153 | -1.376192 | 0.119322 |

| Factor | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|
| $SiO_2$ | -0.173893 | -0.398225 | 0.117260 | -0.133116 | 0.334121 | -0.303496 |
| $Al_2O_3$ | -0.269323 | -0.002002 | -0.176689 | 0.231433 | -0.257663 | -0.262197 |
| $Fe_2O_3$ | -0.002830 | 1.021874 | -0.137566 | 0.105272 | 0.239727 | 0.069072 |
| MgO | -0.083753 | -0.203695 | -0.031408 | 0.122439 | -1.388329 | -0.066853 |
| CaO | -0.148498 | -0.139028 | -0.341022 | 0.091147 | 0.332583 | 0.035073 |
| $Na_2O$ | 1.243895 | 0.050113 | 0.013156 | 0.050645 | 0.054547 | 0.326930 |
| $K_2O$ | 0.280763 | 0.136525 | 0.058974 | 0.117482 | -0.008428 | 1.354062 |
| $TiO_2$ | -0.008547 | -0.165557 | 1.391603 | 0.137023 | 0.086221 | 0.034475 |
| $P_2O_5$ | -0.069584 | -0.154477 | -0.139040 | -1.363210 | 0.204052 | -0.150947 |
| MnO | 0.055185 | -0.043274 | -0.074046 | 0.268662 | 0.211497 | 0.014143 |
| S | 0.055709 | -0.169527 | -0.006908 | 0.041648 | -0.282660 | -0.006050 |
| BaO | 0.093060 | -0.001586 | 0.015278 | 0.106943 | -0.030723 | -0.268910 |
| L.O.I. | 0.236686 | -0.072993 | 0.117993 | -0.045189 | 0.405745 | 0.219670 |

Variance from Varimax Factors

| Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % variance | 7.85 | 8.24 | 7.98 | 7.99 | 8.01 | 8.25 | 7.95 | 10.70 | 8.55 | 8.10 | 8.90 | 7.38 |
| cumulative % | 7.85 | 16.09 | 24.07 | 32.06 | 40.08 | 48.33 | 56.28 | 66.98 | 75.53 | 83.63 | 92.53 | 99.91 |

TABLE XXXII. Factor Analysis of trace elements (assumed lognormally distributed) for 148 analyses.

Rotated Varimax Factor Score Matrix

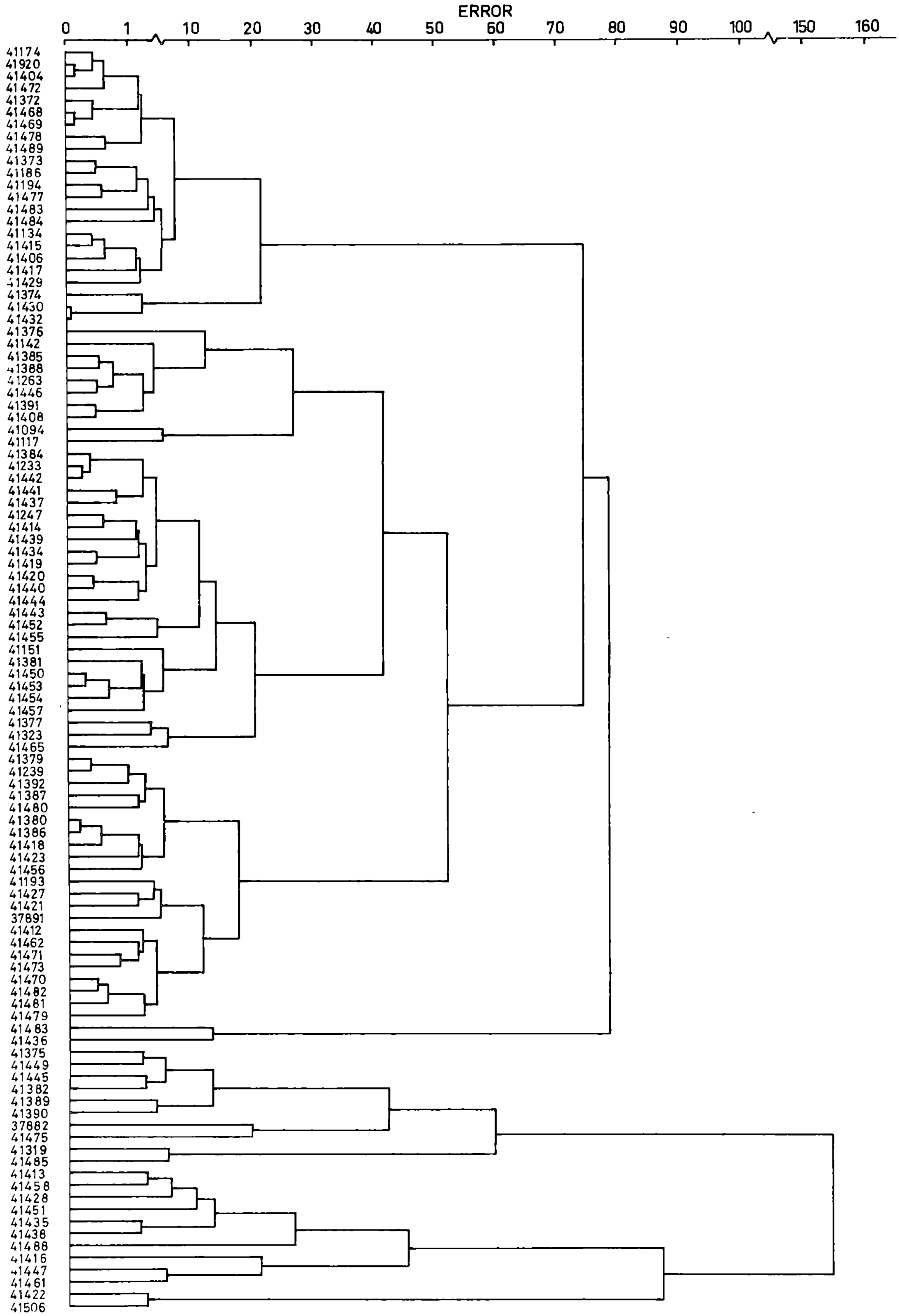
| Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Ba | -0.218627 | 0.724896 | 0.123499 | 0.235508 | 0.119177 | 0.529587 | -0.080273 | -0.138509 |
| Ce | -0.055909 | -0.254822 | -0.012808 | 0.111652 | 0.061325 | -0.043076 | 1.043557 | 0.059046 |
| Cr | 0.075233 | 0.180454 | -0.103333 | 0.074124 | 0.007344 | -0.074680 | -0.104728 | 0.104993 |
| Cu | 0.072629 | 0.152408 | 0.164988 | -0.146920 | 0.058892 | -0.089912 | -0.049007 | -1.097549 |
| Ga | 0.066640 | 0.068626 | -0.026185 | -0.953915 | 0.086709 | 0.083265 | -0.098194 | -0.060293 |
| Ge | -0.036420 | -0.031091 | -0.035955 | 0.317631 | 0.116368 | 0.017340 | -0.005334 | -0.001224 |
| La | 0.011181 | -0.220002 | -0.053459 | 0.011440 | -0.034078 | -0.060750 | -0.030667 | -0.035702 |
| Li | 0.054881 | -0.078110 | 0.218113 | 0.057714 | -0.103892 | -0.049010 | -0.032556 | 0.131068 |
| Nb | -0.108841 | -0.089883 | -0.018723 | 0.049327 | -0.017897 | 0.217508 | -0.006049 | -0.040930 |
| Ni | 0.309183 | -0.118390 | 0.032933 | -0.141004 | -0.041228 | -0.331004 | 0.044277 | -0.144361 |
| Pb | -0.015681 | -0.150598 | 0.005459 | 0.118345 | -0.991912 | 0.072223 | -0.087038 | 0.087359 |
| Rb | 0.096459 | 0.718432 | -0.049246 | -0.271412 | 0.058408 | 0.041568 | -0.291602 | -0.025639 |
| Sc | -0.565836 | 0.247321 | 0.017386 | 0.162228 | 0.068246 | 0.440973 | 0.162387 | 0.136470 |
| Sr | 0.175805 | -0.103443 | -0.088608 | 0.096174 | 0.005734 | -0.092106 | 0.122452 | 0.043482 |
| Th | 0.049234 | 0.175111 | -0.006370 | -0.352543 | -0.154939 | -0.015911 | 0.240515 | -0.042231 |
| Ti | -0.531676 | -0.007986 | 0.155779 | 0.078067 | -0.020033 | -0.145704 | -0.134727 | 0.023717 |
| V | -0.387414 | -0.080083 | 0.127116 | -0.212420 | -0.111209 | -0.068420 | 0.147350 | -0.096023 |
| Y | 0.092164 | -0.137950 | -0.019508 | 0.009704 | -0.064702 | 0.079222 | -0.086400 | 0.123056 |
| Zn | 0.169202 | -0.040418 | -1.201255 | -0.054359 | -0.009975 | -0.028159 | 0.022656 | 0.166398 |
| Zr | 0.038949 | -0.186473 | -0.002864 | 0.063191 | 0.059345 | -1.354038 | 0.026424 | -0.044854 |

| Factor | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|
| Ba | -0.047625 | -0.219719 | -0.067644 | 0.073411 | 0.034587 | -0.126892 | 0.117097 |
| Ce | -0.003332 | -0.015552 | 0.025868 | 0.002974 | -0.056826 | -0.144824 | 0.017995 |
| Cr | -0.034538 | -0.063584 | -0.203365 | 0.096282 | -0.057947 | 0.073669 | -0.661959 |
| Cu | -0.017824 | 0.042925 | -0.062271 | 0.146886 | -0.220352 | 0.074801 | -0.058359 |
| Ga | 0.216648 | -0.049581 | 0.044920 | 0.039946 | 0.010507 | 0.079532 | -0.024116 |
| Ge | -1.114563 | 0.002299 | 0.015599 | -0.030080 | 0.004842 | 0.060743 | 0.173311 |
| La | -0.008510 | 1.139674 | 0.069691 | -0.014999 | -0.053968 | 0.205213 | 0.046465 |
| Li | -0.020991 | 0.011682 | -0.006203 | -1.121112 | 0.080429 | 0.050245 | 0.023120 |
| Nb | 0.006311 | -0.044247 | -1.290293 | -0.010588 | -0.003602 | -0.036806 | -0.194036 |
| Ni | 0.225576 | 0.002816 | -0.183287 | -0.067420 | 0.296653 | 0.010931 | -0.937687 |
| Pb | 0.116506 | 0.038277 | -0.027084 | -0.138248 | 0.143668 | -0.017149 | -0.021112 |
| Rb | 0.107015 | -0.063362 | 0.243708 | -0.002746 | -0.201244 | 0.278909 | -0.155037 |
| Sc | -0.093731 | -0.221518 | -0.050532 | 0.153938 | -0.035166 | 0.155038 | 0.177474 |
| Sr | 0.076675 | -0.171560 | -0.028923 | 0.045435 | 0.043470 | -1.222504 | 0.043984 |
| Th | -0.080724 | -0.032818 | -0.155657 | 0.141524 | -0.392381 | 0.081743 | -0.085272 |
| Ti | 0.021295 | 0.070618 | -0.141025 | -0.043099 | 0.055728 | 0.065363 | 0.204257 |
| V | 0.026809 | 0.175994 | -0.027389 | 0.005835 | -0.416846 | 0.200900 | 0.129790 |
| Y | 0.042372 | -0.016185 | 0.034902 | -0.050269 | 1.056398 | 0.012930 | -0.172060 |
| Zn | -0.038982 | 0.052806 | -0.026412 | 0.212046 | -0.028796 | -0.073406 | -0.061269 |
| Zr | -0.015913 | -0.003807 | 0.162205 | -0.013754 | -0.076274 | -0.068930 | -0.140140 |

Variance from Varimax Factors

| Factor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % variance | 13.38 | 10.73 | 5.01 | 5.74 | 5.68 | 4.23 | 5.85 | 5.60 | 5.46 | 5.18 | 4.98 | 5.20 | 5.33 | 4.92 | 9.28 |
| cumulative % | 13.38 | 24.11 | 29.11 | 34.85 | 40.53 | 44.77 | 50.61 | 56.22 | 61.68 | 66.86 | 71.84 | 77.03 | 82.36 | 87.28 | 96.56 |

FIGURE I. Dendrogram showing Hierarchical Grouping of all analyses from the Lyell-Darwin and Elliott Bay areas on the basis of their major and minor element composition, assumed normally distributed.


ERROR
0
1
10
20
30
40
50
60
70
80
90
100
150
160
41174
41920
41404
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41372
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41480
41380
41386
41418
41423
41456
41193
41427
41421
37891
41412
41462
41471
41473
41470
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41390
37882
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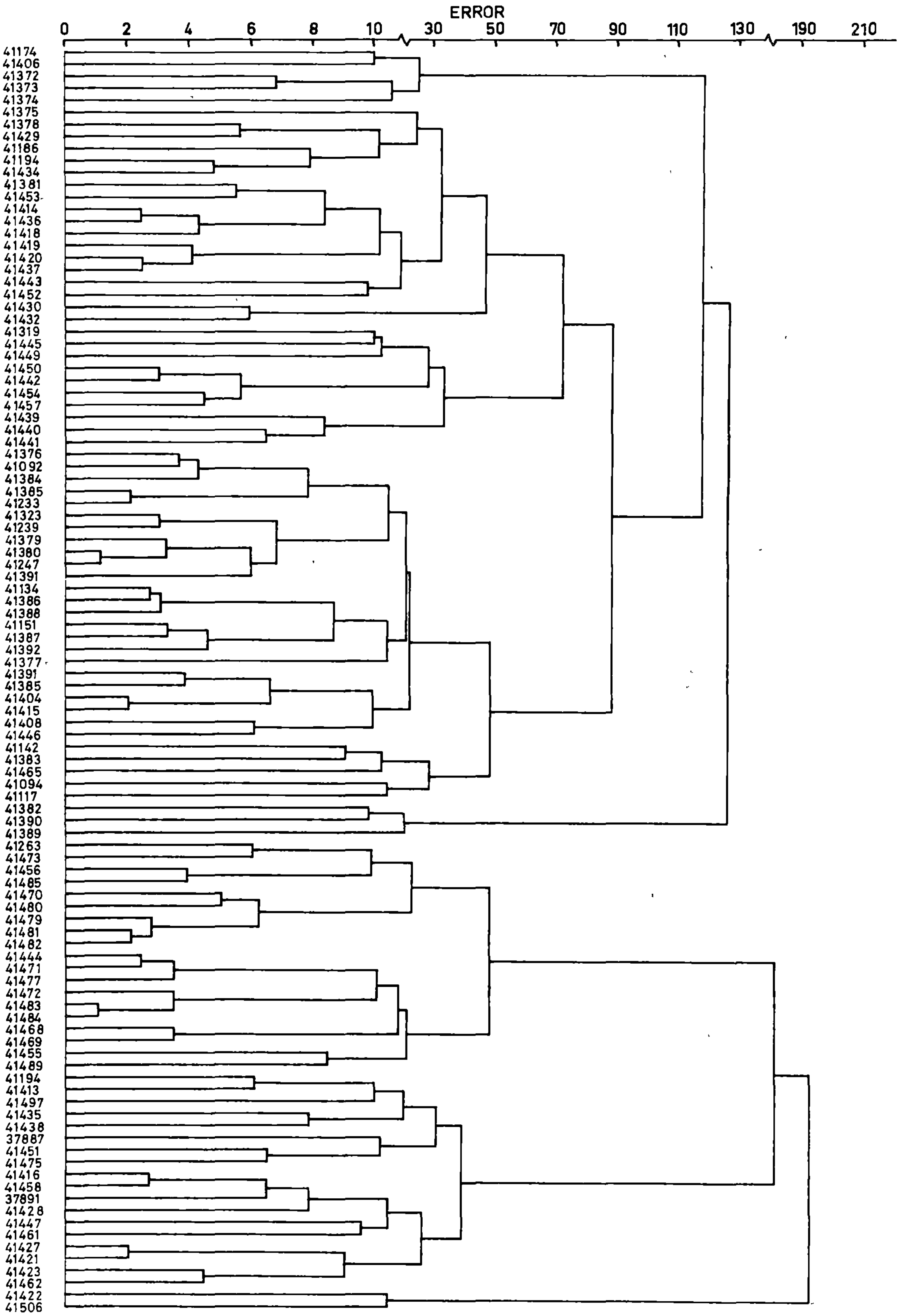
FIGURE II. Dendrogram showing Hierarchical Grouping of all analyses from the Lyell-Darwin and Elliott Bay areas, on the basis of their trace element composition, assumed log-normally distributed.


ERROR
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2
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6
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10
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50
70
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110
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210
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41455
41489
41194
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41497
41435
41438
37887
41451
41475
41416
41458
37891
41428
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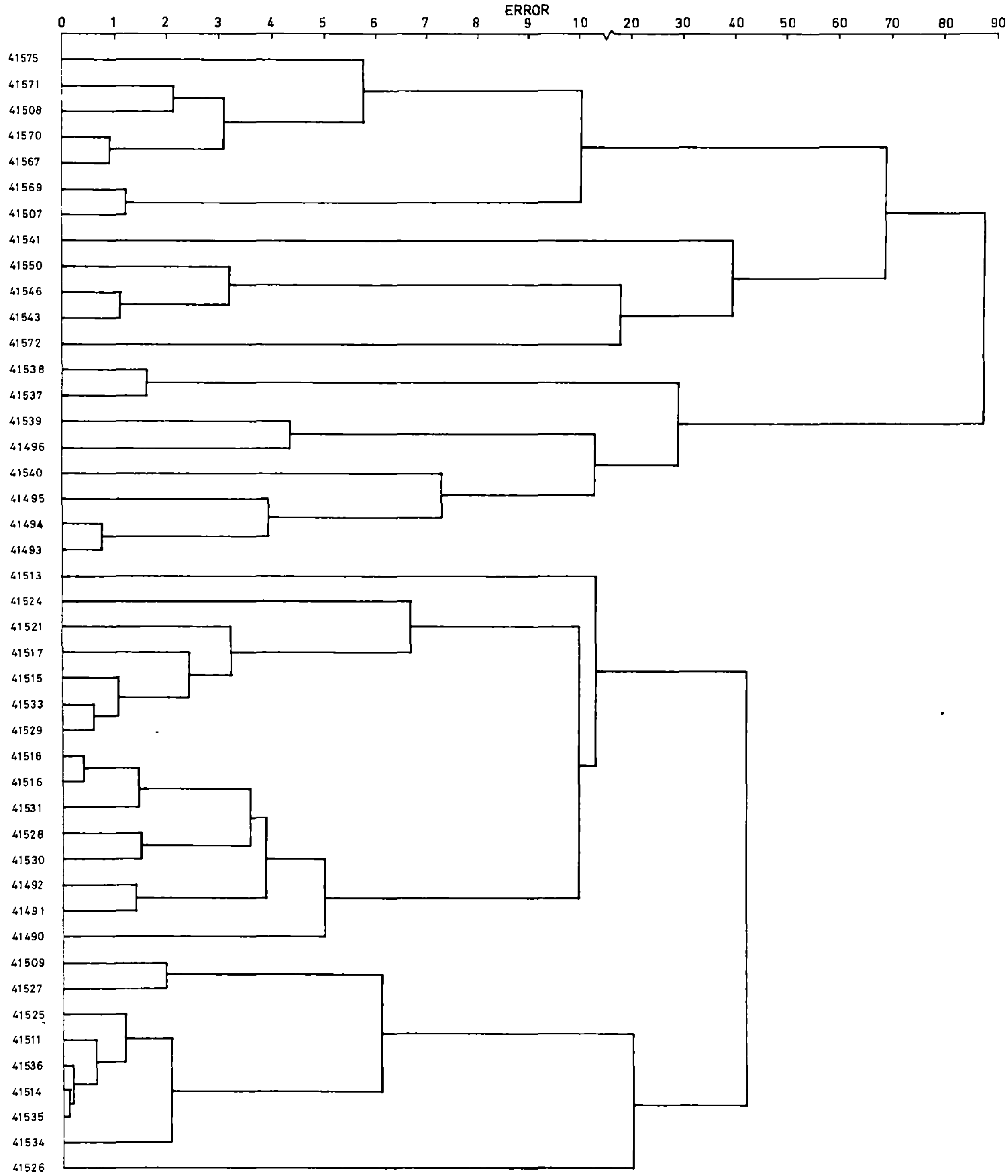
FIGURE III. Dendrogram showing Hierarchical Grouping of all analyses from the Noddy Creek and Double Cove areas on the basis of their major and minor element composition, assumed normally distributed.


ERROR
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41528
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41492
41491
41490
41509
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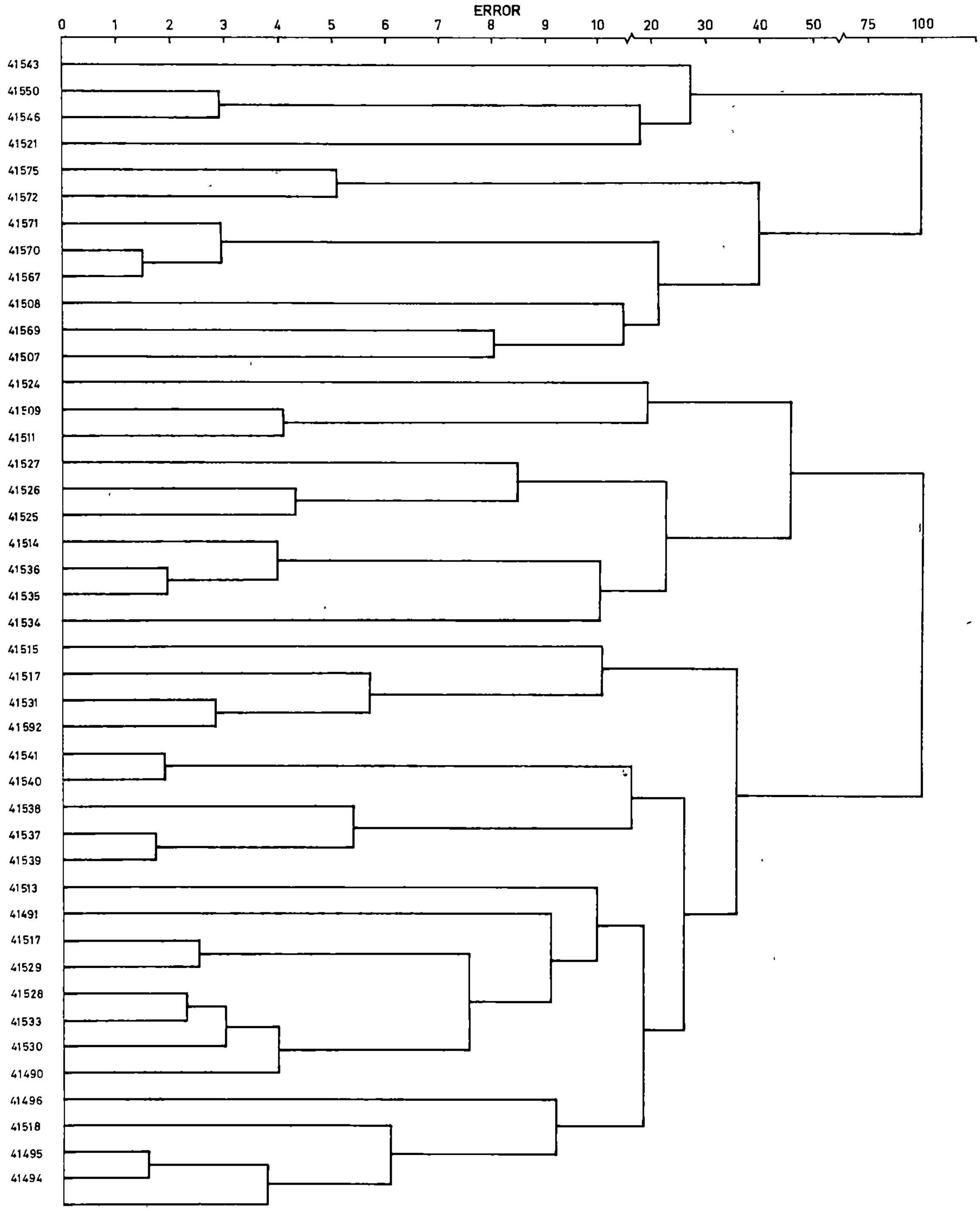
FIGURE IV. Dendrogram showing Hierarchical Grouping of all analyses from the Noddy Creek and Double Cove areas on the basis of their trace element composition, assumed log-normally distributed.



ERROR
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41537
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41491
41517
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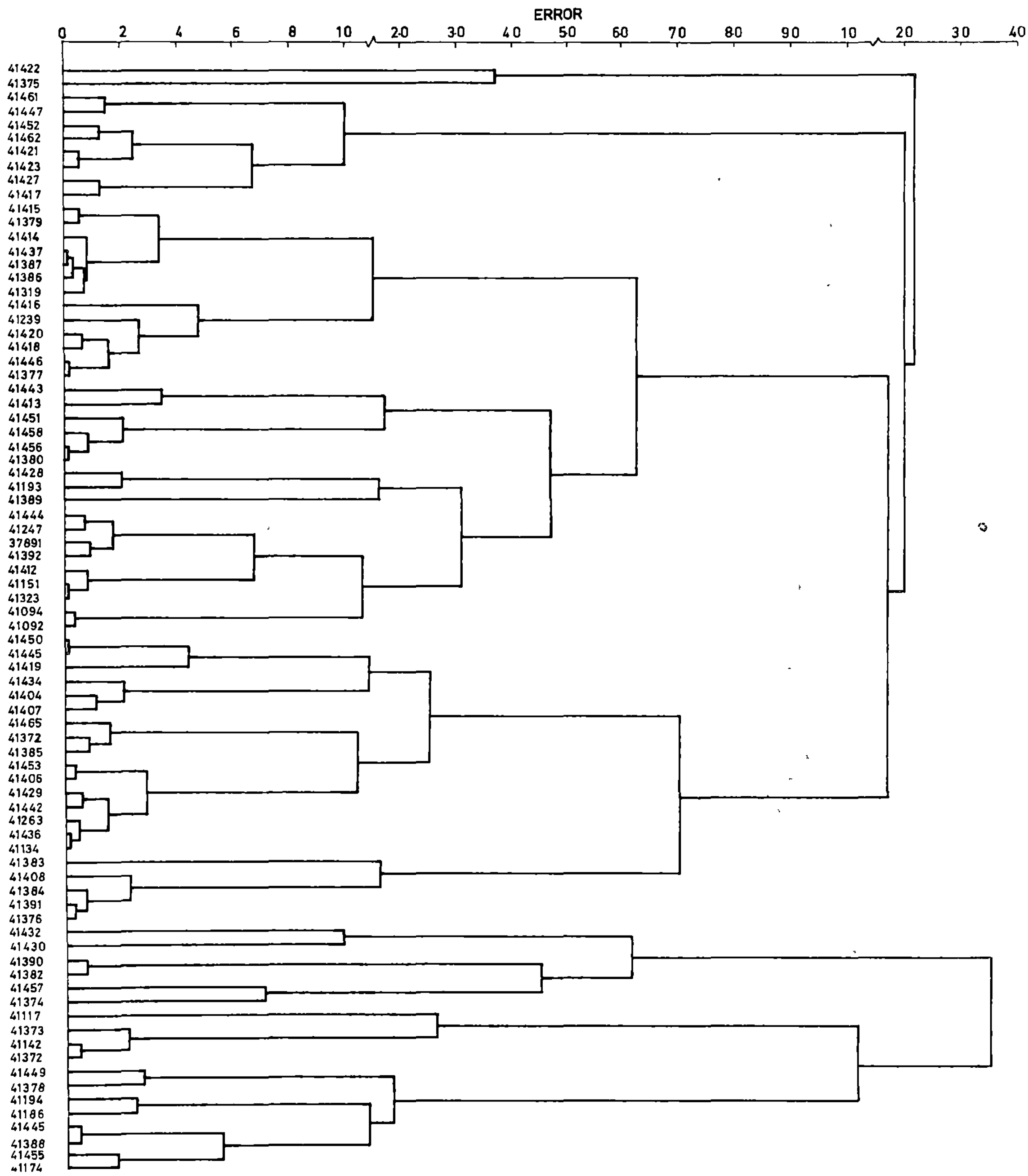
FIGURE V. Dendrogram showing Hierarchical Grouping of all analyses from the Lyell-Darwin area on the basis of trace element factor scores for factors 1 (Sc, Ti, V), 2 (Ba, Rb) and 6 (Ba, Sc, Zr).


ERROR
0 2 4 6 8 10 20 30 40 50 60 70 80 90 10 20 30 40
41422
41375
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# APPENDIX IV

## LOCATION OF B.H.P. SLIDES

Collected by E.S. Corbett and B. Cuffley, slides now located at B.H.P. House, Melbourne. Locations as recorded on slides.

| | | |
|---|---|---|
| F2 | 58/7 | saddle between Findons Creek and Snake Peak ridge |
| F3 | 58/8 | ridge just E of Findons Creek |
| F7 | 58/12 | W slope of Snake Spur |
| F12 | 58/17 | Findons Creek above upper workings |
| F13 | 58/18 | Findons workings S of trench on knob above adit |
| F17 | 58/22 | first N of divide between Conglomerate Peak and Intercolonial Spur |
| F25 | 58/30 | workings at head of Allans Creek |
| F30 | 58/35 | Allan Creek S branch above junction |
| F32 | 65/1 | Portal Prince Darwin adit |
| F33 | 65/2 | Prince Darwin North adit |
| F34 | 65/3 | above Prince Darwin North adit |
| F36 | 65/5 | breccia, dump Prince Darwin North adit |
| F40 | 65/9 | quartz-sericite schist, below Prince Darwin North adit |
| F41 | 65/10 | Tasman Darwin, near where adit should be |
| F42 | 65/11 | rhyolite, Tasman Darwin mine position |
| F43 | 65/12 | sheared rhyolite, Tasman Darwin, near mine position |
| F44 | 65/13 | porphyritic rhyolite - flat area 150 feet above Tasman Darwin position |
| F45 | 65/14 | flat area 150 feet above Tasman Darwin mine |
| F46 | 65/15 | base of bare slope above Tasman Darwin |
| F46A | 65/16 | area N of bare slope above Tasman Darwin |
| F47 | 65/17 | creek N of bare slope above Tasman Darwin |
| F48 | 65/18 | upper part of first creek N of Tasman Darwin |
| F49 | 65/19 | N side creek below Humpty Dumpty conglomerate peak |

| | | |
|---|---|---|
| F50 | 65/20 | Prince Darwin lower end of No. 1 traverse (U.S. Metals) |
| F51 | 65/21 | 300 feet S of Prince Darwin S adit |
| F53 | 65/23 | line 3 half mile S of Prince Darwin S adit |
| F54 | 65/24 | line 4 half mile S of Prince Darwin adit |
| F55 | 65/25 | line 4, half mile S of Prince Darwin S adit |
| F57 | 65/27 | just S of main knoll of ridge down to Tasman Darwin |
| F58 | 65/28 | N of Humpty Dumpty |
| F58' | 58/37 | Upper Lake Jukes Helipad |
| F59 | 58/38 | E face Adit Knob, Lake Jukes |
| F60 | 58/39 | E face Adit Knob, Lake Jukes |
| F63 | 58/42 | near adit No. 3 , Lake Jukes |
| F69 | 58/49 | track two-thirds of mile below Lake Jukes camp on S side of main swampy flat |
| F70 | 58/50 | as for F69 |
| F70A | 58/51 | near track on ridge N of middle branch of Fish Creek |
| F74 | 58/53 | ridge above Bean and Thow workings |
| F76 | 58/56 | NW end of ridge of Lake Jukes helipad |
| F77 | 58/57 | track half mile below Lake Jukes helipad |
| F78 | 58/58 | track half mile below Upper Lake Jukes helipad |
| F79 | | no location given |
| F80 | 58/60 | track three-quarters of mile below Lake Jukes helipad in swamp |
| F81 | | no location given |
| F82 | 58/62 | ridge N of track at middle branch of Fish Creek |
| F83 | | no location given |
| F84 | 58/64 | ridge S of Bean and Thow |
| F85 | 58/65 | track NE side of Bean and Thow ridge |
| F86 | 58/66 | SE face of ridge S of Bean and Thow |
| ED1 | 58/69 | Dillons No. 1 Winze |
| D2 | 65/29 | knoll N of camp on South Darwin Plateau |
| D3 | 69/30 | highest point on W edge of Darwin Plateau |

| | | |
|---|---|---|
| D4 | 69/31 | highest point on W edge of Darwin Plateau |
| D5 | 69/32 | S Darwin Plateau |
| D6 | 69/33 | S Darwin Plateau |
| D7 | 69/34 | S Darwin Plateau |
| D8 | 69/35 | Razorback Spur? |
| D10 | 69/36 | N face Mount Darwin |
| D11 | | N face Mount Darwin |
| D12 | 58/72 | W edge plateau between Snake Peak and Mount Darwin |
| D13 | 69/38 | near South Darwin Peak |
| D14 | 58/69 | Jukes Pty. No. 3 adit |
| D15 | 58/70 | 400 N 330 W Jukes Pty. grid |
| D16 | 58/71 | 400 S 236 W Jukes Pty. grid |
| F29 | 58/34 | Allan Ck. S. branch near junction |

# APPENDIX V

## SAMPLE LOCATIONS

Abbreviations used:

TS = thin section

PS = polished thin section

PB = polished block

WA = whole rock analysis, major and trace elements

PA = partial rock analysis

TA = trace element analysis of pyrite

Note: Owing to the unavailability of suitable metric scale maps, grid references are given in yards.

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41086 | P3 | PS | | see Figure VI | |
| 87 | P4 | TS | | " " | " |
| 88 | P6 | PB | | " " | " |
| 89 | P12 | TS, PB | | " " | " |
| 90 | P13 | TS | | " " | " |
| 91 | P14 | | | " " | " |
| 92 | P15, X7 | TS, WA | | " " | " |
| 93 | P16, X8 | TS, WA | | " " | " |
| 94 | P17 | PS | | " " | " |
| 95 | P18 | PS | | " " | " |
| 96 | P19 | PS | diggings in rhyolite body enclosed in granite | 3625 | 7937 |
| 97 | P21 | TS | | see Figure VI | |
| 98 | P23 | TS | | " " | " |
| 99 | P24 | TS | | " " | " |
| 41100 | P26 | PS, TA | | " " | " |
| 01 | P27 | TS | | " " | " |
| 02 | P29 | TA | | " " | " |
| 03 | P30 | TA | | " " | " |
| 04 | P34 | TS, TA | | " " | " |
| 05 | P37 | PB, PS | South Darwin Peak | 3626 | 7928 |
| 06 | P38 | TS | | 3627 | 7934 |
| 07 | P39 | TS | | 3627 | 7935 |
| 08 | P40 | TS | | 3630 | 7936 |
| 09 | P41 | TS | | 3626 | 7937 |
| 10 | P44 | PS | | see Figure VI | |
| 11 | P47 | PS | | " " | " |
| 12 | P48 | PS | | " " | " |
| 13 | P49 | TA | | " " | " |
| 14 | P50 | TS | | " " | " |
| 15 | P51 | PB | | " " | " |
| 16 | P52 | PB | | " " | " |
| 17 | P53, X10 | PB, WA | | " " | " |
| 18 | P54 | PS, PB | | " " | " |
| 19 | P55 | TS, PB | | " " | " |
| 20 | P56 | PB | | " " | " |
| 21 | P57 | | | " " | " |
| 22 | P58 | PB | | " " | " |
| 23 | P65 | TS, PS | | " " | " |

| Department Number | Field Number | Treatment | | East-ing | North-ing |
|---|---|---|---|---|---|
| 41124 | P66 | PB | | see Figure VI | |
| 25 | P67 | TA | mouth Prince Darwin Adit | " " | " |
| 26 | P68 | | " " " " | " " | " |
| 27 | P69 | | mouth North Prince Darwin Adit | 3617 | 7953 |
| 28 | P70 | TS | | see Figure VI | |
| 29 | P71 | PS | | " " | " |
| 30 | P72 | TS | | " " | " |
| 31 | P73 | TS | | " " | " |
| 32 | P74 | TS | | " " | " |
| 33 | P75 | TS | | " " | " |
| 34 | P76, X11 | TS, WA | | " " | " |
| 35 | P77 | TS | | " " | " |
| 36 | P78 | TS | | " " | " |
| 37 | P79 | TS | | " " | " |
| 38 | P80 | TS, TA | | " " | " |
| 39 | P81 | PS | | " " | " |
| 40 | P82 | PS | | " " | " |
| 41 | P83 | TS, TA | | " " | " |
| 42 | P84, X12 | TS, WA | | " " | " |
| 43 | P85 | TS | | " " | " |
| 44 | P86 | TS | | " " | " |
| 45 | P87 | TS | | " " | " |
| 46 | P88 | TS | | " " | " |
| 47 | P89 | | | " " | " |
| 48 | P90 | TS | | " " | " |
| 49 | P41 | TS | "Humpty Dumpty" | 3616 | 7927 |
| 50 | D2 | TS | adjacent to granite | 3634 | 7952 |
| 51 | D3, X14 | TS,WA | 10 m E of granite contact | 3634 | 7952 |
| 52 | D4B | TS | | 3635 | 7952 |
| 53 | D4 | TS | | 3635 | 7952 |
| 54 | D5 | | | 3636 | 7951 |
| 55 | D6 | TS | | 3636 | 7951 |
| 56 | D7 | TS | | 3638 | 7950 |
| 57 | D8 | TS | | 3639 | 7949 |
| 58 | D12 | TS | | 3645 | 7945 |
| 59 | D13 | TS | | 3631 | 7952 |
| 60 | D14 | TS | volcanics enclosed in granite | 3631 | 7956 |
| 61 | D16 | TS,PS | | 3630 | 7957 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41162 | D17 | TS | | 3630 | 7961 |
| 63 | D19 | TS | | 3633 | 7965 |
| 64 | D20 | TS | | 3633 | 7965 |
| 65 | D21 | | | 3633 | 7967 |
| 66 | D23 | | | 3633 | 7967 |
| 67 | D24 | TA | | 3634 | 7950 |
| 68 | D25 | TA | | 3634 | 7950 |
| 69 | D26 | TS,PS,TA | | 3634 | 7950 |
| 70 | D27 | TS | beside access road | 3632 | 7951 |
| 71 | D28 | TS | Mount Darwin, highest point | 3625 | 7977 |
| 72 | D29 | TS | | 3633 | 7966 |
| 73 | D30 | TS | | 3632 | 7966 |
| 74 | D31, X1 | TS, WA | at B.H.P. core shed | 3625 | 7948 |
| 75 | D32 | TS | | 3625 | 7948 |
| 76 | D80 | TS, PS | | 3631 | 7951 |
| 77 | D81 | PS | | 3631 | 7951 |
| 78 | D82 | TS | east of gold workings on Darwin Plateau | 3635 | 7960 |
| 79 | D83 | TS | | 3634 | 7960 |
| 80 | D84 | TS | xenolith in granite, Au workings | 3633 | 7961 |
| 81 | D86 | TS | | 3632 | 7942 |
| 82 | D87 | TA | | 3616 | 7932 |
| 83 | D88 | PB, TA | | 3616 | 7932 |
| 84 | D89 | TS | on Razorback Spur | 3625 | 7965 |
| 85 | D90 | TS | | 3629 | 7975 |
| 86 | C1 | TS, WA | outcrop in Clark R. | 3605 | 7935 |
| 87 | C2i | TS, PB | float in Clark R. | 3605 | 7935 |
| 88 | C2ii | TS | " " " | 3605 | 7935 |
| 89 | C2iii | TS | " " " | 3605 | 7935 |
| 90 | C2iv | TS | " " " | 3605 | 7935 |
| 91 | C2v | TS | " " " | 3605 | 7935 |
| 92 | C3 | TS | outcrop in Clark R. | 3608 | 7954 |
| 93 | C4 | TS, WA | " " " | 3608 | 7952 |
| 94 | C5 | TS, WA | " " " | 3605 | 7944 |
| 95 | A2 | TS | on main ridge E, S of Allans Ck. | 3636 | 7990 |
| 96 | A3 | TS | " " " " | 3637 | 7991 |
| 97 | A4 | PS | S side of head of Dardus Ck. | 3635 | 7985 |
| 98 | A5 | TS | in Allan Ck. | 3645 | 7995 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41199 | A6 | TS | in Allan Ck. | 3645 | 7994 |
| 41200 | A7 | TS | " " | 3644 | 7994 |
| 01 | A8 | TS | " " | 3643 | 7995 |
| 02 | A9 | | | 3633 | 7995 |
| 03 | A11 | TS | | 3633 | 7984 |
| 04 | A13 | TS | on level before steep drop to E | 3638 | 7984 |
| 05 | A14 | PS | trench | 3636 | 7982 |
| 06 | A17 | PS, TA | cut above adit | 3628 | 7982 |
| 07 | A18 | TS | mouth of adit | 3628 | 7982 |
| 08 | F1 | TS | | 3622 | 7998 |
| 09 | F2 | TS | | 3623 | 8005 |
| 10 | F3 | TS | | 3623 | 8005 |
| 11 | F4 | TS | | 3622 | 8005 |
| 12 | F5 | PS | | 3627 | 8004 |
| 13 | F6 | TS, PS | | 3627 | 8004 |
| 14 | H1 | TS | | 3619 | 8036 |
| 15 | H2 | PS | cut in S bank, Hydes Ck. | 3620 | 8036 |
| 16 | H3 | PS | | 3620 | 8036 |
| 17 | H6 | PB | 15 m SW of shaft in barite | 3625 | 8024 |
| 18 | H7 | TS | | 3626 | 8024 |
| 19 | H8 | PS | | 3624 | 8032 |
| 20 | H9 | TS | | 3624 | 8032 |
| 21 | M1 | TS | 100 m upstream from waterfall | 3646 | 8023 |
| 22 | M2 | TS | | 3643 | 8024 |
| 23 | M3 | TS | | 3642 | 8025 |
| 24 | M4 | TS | | 3640 | 8026 |
| 25 | M5 | TS | below waterfall | 3646 | 8022 |
| 26 | M6 | TS | | 3626 | 8045 |
| 27 | M7 | TS | | 3620 | 8026 |
| 28 | M9 | TS | | 3623 | 8027 |
| 29 | M10 | TS | | 3623 | 8027 |
| 30 | M11 | TS | | 3623 | 8027 |
| 31 | M12 | TS | | 3625 | 8025 |
| 32 | M13 | TS | E side of Knob | 3626 | 8024 |
| 33 | M14, X21 | TS, WA | " " | 3626 | 8024 |
| 34 | M15 | TS | " " | 3626 | 8024 |
| 35 | M16 | TS | " " | 3626 | 8024 |
| 36 | M17 | | | 3627 | 8023 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41237 | M18 | TS | 20 m above adit in barite | 3627 | 8025 |
| 38 | M19 | TS | 30 m E of adit in barite | 3628 | 8025 |
| 39 | M20, X23 | TS, WA | | 3631 | 8018 |
| 40 | M21 | TS | | 3632 | 8018 |
| 41 | M22 | TS | | 3634 | 8018 |
| 42 | ED2 | TS | on pack track | 3645 | 8002 |
| 43 | ED3 | TS | " " | 3643 | 8003 |
| 44 | ED4 | TS | " " | 3640 | 8005 |
| 45 | ED5 | TS | " " | 3639 | 8005 |
| 46 | ED6 | TS | " " | 3639 | 8005 |
| 47 | ED7, X31 | TS, WA | " " | 3638 | 8005 |
| 48 | ED8 | TS | on track near branch to Pearces Adit | 3637 | 8006 |
| 49 | ED9 | TS | in scrub on track to Darwin Pty. Adit | 3637 | 8006 |
| 50 | ED10 | TS | on pack track | | |
| 51 | ED11 | TS | on pack track in gully | | |
| 52 | ED12 | TS | trench No. 1 | see Figure VII | |
| 53 | ED13 | PS, TA | " " | " " " | |
| 54 | ED14A | PS | " " | " " " | |
| 55 | ED14B | TA | " " | " " " | |
| 56 | ED14C | PS | " " | " " " | |
| 57 | ED16A | TS | on pack track | " " " | |
| 58 | ED17A | TS | " " | " " " | |
| 59 | ED17B | TS | " " | " " " | |
| 60 | ED17C | TS | " " | " " " | |
| 61 | ED18A | TS | " " | " " " | |
| 62 | ED18B | TS | " " | " " " | |
| 63 | ED19, X32 | TS, WA | " " | 3635 | 8001 |
| 64 | ED21 | TS | | 3632 | 8000 |
| 65 | ED22 | TS | Dillons No. 1 Adit dump | see Figure VII | |
| 66 | ED25 | TS | " " " | " " " | |
| 67 | ED26 | TS | " " " | " " " | |
| 68 | ED27B | PS | " " " | " " " | |
| 69 | ED28 | TS | " " " | " " " | |
| 70 | ED29 | TS | " " " | " " " | |
| 71 | ED30 | PS, TA | " " " | " " " | |
| 72 | ED31 | TA | " " " | " " " | |
| 73 | ED32 | TA | " " " | " " " | |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41274 | ED33 | TA | Dillons No. 1 Adit dump | see Figure VII | |
| 75 | ED34 | PS | " " " | " " | " |
| 76 | ED35 | TS | entrance to Souters Adit | " " | " |
| 77 | ED36A | TS, TA | Souters Adit dump | " " | " |
| 78 | ED36B | PB | " " " | " " | " |
| 79 | ED36C | TS | " " " | " " | " |
| 80 | ED36D | PB, TA | " " " | " " | " |
| 81 | ED36F | TS | " " " | " " | " |
| 82 | ED36S | PB, TA | " " " | " " | " |
| 83 | ED36W | TS | " " " | " " | " |
| 84 | ED37 | TS | entrance to Dillons No. 2 Adit | " " | " |
| 85 | ED39 | TS | end of Dillons No. 2 Adit | " " | " |
| 86 | ED40E | PB | Dillons No. 2 Adit dump | " " | " |
| 87 | ED40G | PB, TA | " " " " | " " | " |
| 88 | ED40H | TA | " " " " | " " | " |
| 89 | ED41A | TA | trench No. 4 | " " | " |
| 90 | ED42 | TS | " " | " " | " |
| 91 | ED43A | PS, TA | trench No. 3 | " " | " |
| 92 | ED43B | TA | " " | " " | " |
| 93 | ED44C | TA | small unnamed adit dump | " " | " |
| 94 | ED44D | PS, TA | " " " " | " " | " |
| 95 | ED44E | PB | " " " " | " " | " |
| 96 | ED45 | TA | trench No. 2 | " " | " |
| 97 | ED46 | PB, TA | " " | " " | " |
| 98 | ED47 | PS, TA | " " | " " | " |
| 99 | ED49 | PS, TA | Pearces Adit dump | " " | " |
| 41300 | ED50 | PS | " " " | " " | " |
| 01 | ED51 | TS | " " " | " " | " |
| 02 | ED53 | TS | " " " | " " | " |
| 03 | ED55 | PS, TA | " " " | " " | " |
| 04 | ED57 | TS | cut in creek near Mount Darwin Pty. Adit | " " | " |
| 05 | ED58C | TS | " " " " | " " | " |
| 06 | ED58D | PB | " " " " | " " | " |
| 07 | ED59A | TS | " " " " | " " | " |
| 08 | ED59B | TS | " " " " | " " | " |
| 09 | ED60 | TS | | 3650 | 8005 |
| 10 | ED62 | TS | | 3634 | 8007 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41311 | ED63 | TS, TA | | 3634 | 8007 |
| 12 | EDA1 | PA | trench No. 1 | see Figure VII | |
| 13 | EDA2 | PA | " " | " " | " |
| 14 | EDA3 | PA | " " | " " | " |
| 15 | EDA4 | PA | " " | " " | " |
| 16 | EDA5 | PA | " " | " " | " |
| 17 | EDB1 | PA | trench No. 2 | " " | " |
| 18 | EDB2 | PA | " " | " " | " |
| 19 | EDB3 | TS,PA,WA | " " | " " | " |
| 20 | EDB4 | PA | " " | " " | " |
| 21 | EDB5 | PA | " " | " " | " |
| 22 | EDC1 | PA | trench No. 3 | " " | " |
| 23 | EDC2 | TS, PA | " " | " " | " |
| 24 | EDC3 | PA, WA | " " | " " | " |
| 25 | EDD1 | PA | small un-named adit | " " | " |
| 26 | EDD2 | PA | " " " | " " | " |
| 27 | EDE | PA | trench No. 4 | " " | " |
| 28 | EDE1 | PA | " " | " " | " |
| 29 | EDE2 | PA | " " | " " | " |
| 30 | EDE3 | PA | " " | " " | " |
| 31 | EDE4 | PA | " " | " " | " |
| 32 | | | | 3628 | 8020 |
| 33 | L1 | TS | Bean and Thow | 3633 | 8057 |
| 34 | L2 | TS | mouth of large (SE) adit | 3625 | 8058 |
| 35 | L3 | TS | near inner end of adit | 3624 | 8058 |
| 36 | L4A | PS | dump of small higher adit | 3624 | 8059 |
| 37 | L4B | PB | " " " " | 3624 | 8059 |
| 38 | L4C | TS | " " " " | 3624 | 8059 |
| 39 | L5 | PS | near top of Adit Knob | 3624 | 8059 |
| 40 | L6A | TS | dump of third adit high on Knob | 3624 | 8059 |
| 41 | L6B | PB | " " " " | 3624 | 8059 |
| 42 | L6C | PB | " " " " | 3624 | 8059 |
| 43 | L6D | PB | " " " " | 3624 | 8059 |
| 44 | L7 | TS | beside crusher site | 3625 | 8057 |
| 45 | L8 | TS | centre of swamp | 3630 | 8056 |
| 46 | L9 | TS | | 3632 | 8057 |
| 47 | L10 | TS | on track | 3633 | 8057 |
| 48 | J1 | PS | dump No. 1 (i.e. top) adit | 3629 | 8087 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41349 | J2 | PS | | 3630 | 8090 |
| 50 | J3 | PS | small adit below creek junction | 3631 | 8092 |
| 51 | J4 | PS | No. 3 (middle) adit, inside at end | 3630 | 8088 |
| 52 | J5 | PB | hematite body | 3631 | 8091 |
| 53 | J7A | PS, TA | creek junction | 3632 | 8092 |
| 54 | J7B | PB | " " | 3632 | 8092 |
| 55 | J8A | PS | No. 2 (lower) adit, dump | 3631 | 8088 |
| 56 | J8B | PS | " " " " | 3631 | 8088 |
| 57 | J9 | TS | | 3630 | 8087 |
| 58 | J10 | TS | | 3629 | 8087 |
| 59 | J11 | TS | | 3627 | 8088 |
| 60 | J12 | TS | | 3628 | 8088 |
| 61 | J14 | 2PB, TA | | 3631 | 8092 |
| 62 | J20 | TS | on pack track | 3640 | 8080 |
| 63 | J21 | TS | | 3634 | 8084 |
| 64 | J22 | TS | | 3632 | 8087 |
| 65 | J23 | TS | | 3621 | 8093 |
| 66 | J24 | PS | small adit | 3621 | 8093 |
| 67 | J25 | TS | | 3630 | 8081 |
| 68 | K1 | TS | | 3640 | 8097 |
| 69 | K2 | TS | | 3644 | 8097 |
| 70 | K3 | TS | | 3645 | 8097 |
| 71 | K4 | TS | | 3649 | 8092 |
| 72 | X2 | TS, WA | near B.H.P. core shed | 3625 | 7948 |
| 73 | X3 | TS, WA | | 3631 | 7953 |
| 74 | X4 | TS, WA | | 3631 | 7962 |
| 75 | X5 | WA | beside access road | 3632 | 7951 |
| 76 | X6 | TS, WA | | see Figure VII | |
| 77 | X9 | TS, WA | | " " " | |
| 78 | X13 | TS, WA | | " " " | |
| 79 | X15 | TS, WA | | 3637 | 7951 |
| 80 | X16 | TS, WA | | 3645 | 7945 |
| 81 | X17 | TS, WA | mouth of Hydes Adit | 3620 | 8037 |
| 82 | X18 | TS, WA | cut in S side Hydes Ck. | 3621 | 8037 |
| 83 | X19 | TS, WA | | 3625 | 8027 |
| 84 | X20 | TS, WA | near shaft in barite | 3625 | 8025 |
| 85 | X22 | TS, WA | just N of knob | 3628 | 8021 |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41386 | X24 | TS, WA | | 3633 | 8018 |
| 87 | X25 | TS, WA | approx. | 3637 | 8017 |
| 88 | X26 | TS, WA | inner end No. 1 (top) Adit, Jukes Pty. | 3628 | 8087 |
| 89 | X27 | TS, WA | dump, No. 1 Adit, Jukes Pty. | 3628 | 8087 |
| 90 | X28 | TS, WA | dump, No. 3 (middle) Adit, Jukes Pty. | 3630 | 8088 |
| 91 | X29 | TS, WA | No. 2 (lowest) Adit, Jukes Pty. | 3631 | 8088 |
| 92 | X30 | WA | 50 m upstream from donkey engine | 3646 | 8065 |
| 93 | Y2 | TS | | 3640 | 8115 |
| 94 | Y3 | TS | | 3610 | 8145 |
| 95 | Y4 | TS | prominent face on Whip Spur | 3620 | 8152 |
| 96 | Y5 | TS | " " " | 3620 | 8152 |
| 97 | Y6 | TS | " " " | 3620 | 8152 |
| 98 | Y7 | TS | " " " | 3620 | 8152 |
| 99 | Y8 | TS | " " " | 3620 | 8152 |
| 41400 | Y9 | TS | " " " | 3620 | 8152 |
| 01 | Y10 | TS | " " " | 3620 | 8152 |
| 02 | Y11 | TS | " " " | 3620 | 8152 |
| 03 | Y12 | | " " " | 3620 | 8152 |
| 04 | Y13 | TS, WA | knob on Whip Spur | 3627 | 8161 |
| 05 | Y14 | TS | E of knob on Whip Spur | 3627 | 8161 |
| 06 | Y16 | TS, WA | | 3635 | 8129 |
| 07 | Y17 | TS | | 3635 | 8133 |
| 08 | Y18 | TS, WA | | 3635 | 8137 |
| 09 | Y19 | TS | | 3635 | 8138 |
| 10 | Y20 | | | 3633 | 8138 |
| 11 | Y21 | TS | | 3631 | 8140 |
| 12 | Y22 | TS, WA | bypass on road | 3631 | 8140 |
| 13 | Y24 | TS, WA | | 3628 | 8140 |
| 14 | Y25 | TS, WA | | 3628 | 8141 |
| 15 | Y26 | TS, WA | | 3626 | 8144 |
| 16 | Y28 | TS, WA | | 3617 | 8148 |
| 17 | Y29 | TS, WA | | 3616 | 8148 |
| 18 | Y30 | TS, WA | | 3611 | 8144 |
| 19 | Y31 | TS, WA | | 3610 | 8143 |
| 20 | Y32 | TS, WA | | 3609 | 8142 |

| Department Number | Field Number | Treatment | | East-ing | North-ing |
|---|---|---|---|---|---|
| 41421 | Y33 | TS, WA | | 3607 | 8142 |
| 22 | Y35 | TS, WA | | 3604 | 8143 |
| 23 | Y36 | TS, WA | | 3604 | 8145 |
| 24 | Y38 | | | 3602 | 8145 |
| 25 | Y39 | TS | | 3601 | 8145 |
| 26 | Y40 | TS | | 3599 | 8148 |
| 27 | Y41 | TS, WA | | 3598 | 8149 |
| 28 | Y42 | TS, WA | | 3597 | 8149 |
| 29 | Y43 | TS, WA | | 3595 | 8159 |
| 30 | Y44 | TS, WA | | 3594 | 8159 |
| 31 | Y45 | TS | | 3594 | 8159 |
| 32 | Y47 | TS, WA | | 3587 | 3159 |
| 33 | Y48 | | | 3587 | 8160 |
| 34 | Y49 | TS, WA | | 3586 | 8167 |
| 35 | Y50 | TS, WA | Blow dump | 3632 | 8203 |
| 36 | Y51 | TS, WA | " " | 3632 | 8203 |
| 37 | Y52 | TS, WA | " " | 3632 | 8203 |
| 38 | Y53 | TS, WA | " " | 3632 | 8203 |
| 39 | Y54 | TS, WA | " " | 3632 | 8203 |
| 40 | Y55 | TS, WA | " " | 3632 | 8203 |
| 41 | Y56 | TS, WA | " " | 3632 | 8203 |
| 42 | Y58 | TS, WA | " " | 3632 | 8203 |
| 43 | Y59 | TS, WA | top adit on Little Owen | 3618 | 8183 |
| 44 | Y60 | TS, WA | " " " " | 3618 | 8183 |
| 45 | Y61 | TS, WA | " " " " | 3618 | 8183 |
| 46 | Y62 | TS, WA | | 3616 | 8176 |
| 47 | Y63 | TS, WA | | 3618 | 8175 |
| 48 | Y64 | TS | adit in head of S. Owen Ck. | 3626 | 8169 |
| 49 | Y65 | TS, WA | | 3624 | 8176 |
| 50 | Y66 | TS, WA | see Figure VIII | 3625 | 8192 |
| 51 | Y67 | TS, WA | " " " | 3625 | 8191 |
| 52 | Y68 | TS, WA | " " " | 3624 | 8190 |
| 53 | Y69 | TS, WA | " " " | 2622 | 8190 |
| 54 | Y70 | TS, WA | " " " | 3622 | 8191 |
| 55 | Y72 | TS, WA | " " " | 3622 | 8192 |
| 56 | Y73 | TS, WA | " " " | 3613 | 8199 |
| 57 | Y74 | TS, WA | " " " | 3613 | 8199 |
| 58 | Y75 | TS, WA | " " " | 3611 | 8199 |
| 59 | Y76 | TS | | 3624 | 8187 |

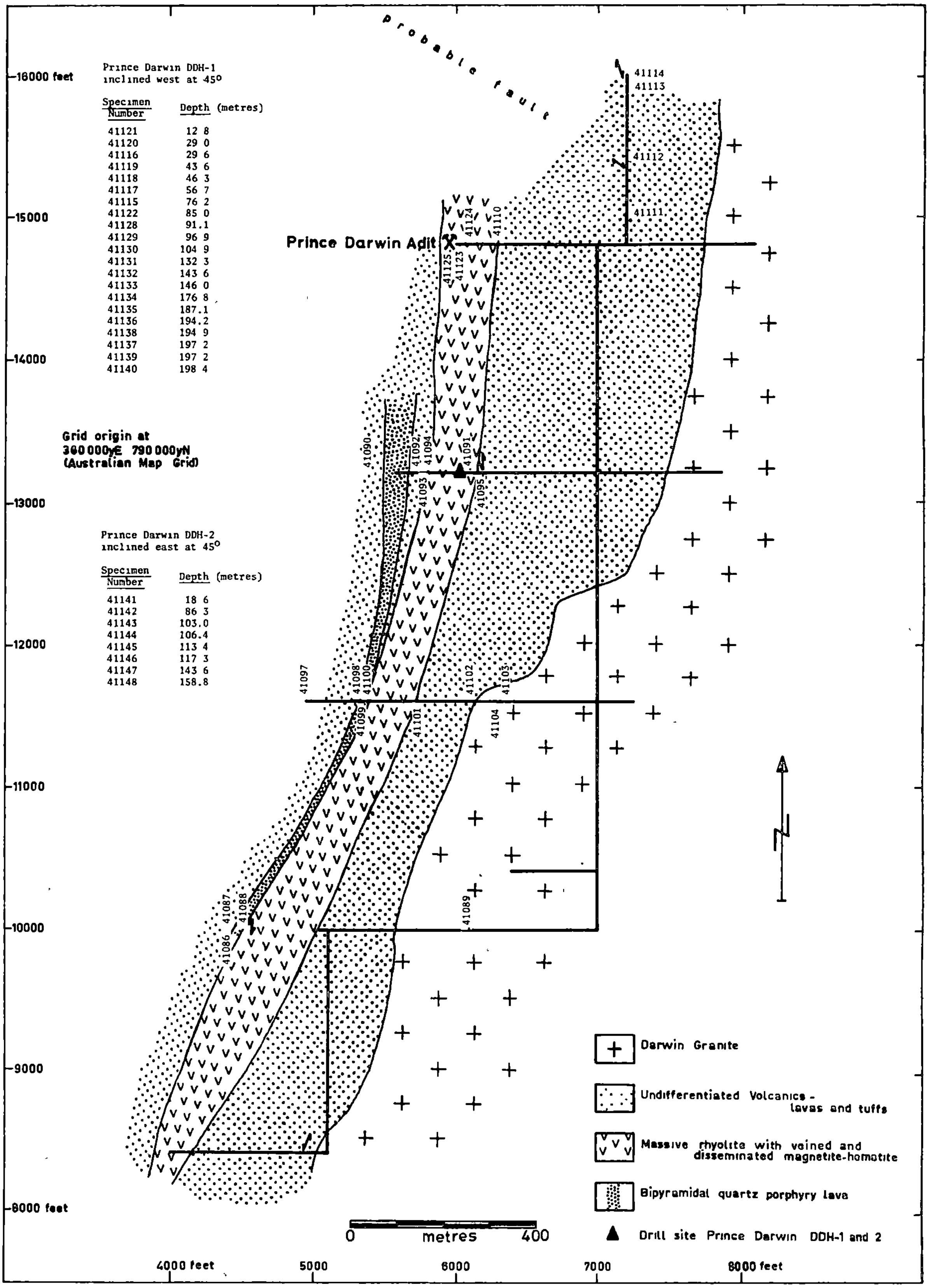
| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41460 | Y77 | TS | Lynch Creek | 3593 | 8148 |
| 61 | Y78 | TS, WA | " " | 3584 | 8148 |
| 62 | Y79 | TS, WA | King R. bridge to Newall | 3578 | 8098 |
| 63 | Y80 | TS | N end, W. Lyell Pit, Dec. 1971 | | |
| 64 | Y81 | TS | " " " " " | | |
| 65 | Y82 | TS, WA | " " " " " | | |
| 66 | ML1 | TA | W. Lyell Pit, 1970 | | |
| 67 | ML2 | TA | open cut, Cape Horn, 1970 | | |
| 68 | S57 | TS, WA | | see Figure 7 | |
| 69 | S58 | TS, WA | | " " | " |
| 70 | S61 | TS, WA | | " " | " |
| 71 | S66 | TS, WA | | " " | " |
| 72 | S69 | TS, WA | | " " | " |
| 73 | S73 | TS, WA | | " " | " |
| 74 | S74 | PB | | " " | " |
| 75 | S55 | TS, WA | | " " | " |
| 76 | S50 | TS | bombardier track SE of Mt. Osmund | | |
| 77 | S51 | TS, WA | | " " | " |
| 78 | S53 | TS | | " " | " |
| 79 | S54 | TS, WA | | " " | " |
| 80 | S56 | TS, WA | | " " | " |
| 81 | S59 | TS, WA | | " " | " |
| 82 | S70 | TS, WA | | " " | " |
| 83 | S71 | TS, WA | | " " | " |
| 84 | S72 | TS, WA | | " " | " |
| 85 | S75 | TS,PB,WA | 100 m S of Penders Prospect | " " | " |
| 86 | S76 | TS, PB | smaller dump, Penders Prospect | " " | " |
| 87 | S77 | TS, 3PB | larger dump, Penders Prospect | " " | " |
| 88 | S78 | TS | between 2 lenses, Penders Prospect | " " | " |
| 89 | S68 | TS, WA | | " " | " |
| 90 | S60 | TS, WA | | " " | " |
| 91 | S62 | TS, WA | | " " | " |
| 92 | S65 | TS, WA | | " " | " |
| 93 | S52 | TS, WA | | " " | " |

| Department Number | Field Number | Treatment | | | Easting | Northing |
|---|---|---|---|---|---|---|
| 41494 | S63 | TS, WA | | | see Figure 7 | |
| 95 | S64 | TS, WA | | | " " " | |
| 96 | S67 | TS, WA | | | " " " | |
| 97 | S79 | TS, WA | midway between Lewis R. and Sassy Ck. | | | |
| 98 | S81 | TS | between Sassy Ck. and Epidote Point | | | |
| 99 | S82 | TS | " " " " | | | |
| 41500 | S83 | TS | " " " " | | | |
| 01 | S84 | TS | " " " " | | | |
| 02 | S85 | TS | " " " " | | | |
| 03 | S86 | TS | 200 m S of mouth of Sassy Ck. | | | |
| 04 | S87 | TS' | " " " " " | | | |
| 05 | S88 | TS | " " " " " | | | |
| 06 | S80 | TS, WA | Epidote Point | | | |
| 07 | S1 | TS, WA | W shore of Birch Inlet | approx. | 3515 | 7710 |
| 08 | S95 | TS | B.H.P. road | " | 3506 | 7669 |
| 09 | S2 | TS, WA | | | see Figure IX | |
| 10 | S3 | TS | | | " " " | |
| 11 | S5 | TS, WA | | | " " " | |
| 12 | S6 | TS | | | " " " | |
| 13 | S7 | TS, WA | | | " " " | |
| 14 | S10 | TS, WA | | | " " " | |
| 15 | S12 | TS, WA | | | " " " | |
| 16 | S13 | TS, WA | | | " " " | |
| 17 | S16 | TS, WA | | | " " " | |
| 18 | S26 | TS, WA | | | " " " | |
| 19 | S27 | TS | | | " " " | |
| 20 | S42 | TS | | | " " " | |
| 21 | S89 | TS, WA | | approx. | 3417 | 7714 |
| 22 | S90 | | | " | 3416 | 7704 |
| 23 | S4 | TS | | | see Figure IX | |
| 24 | S11 | TS, WA | | | " " " | |
| 25 | S22 | TS, WA | | | " " " | |
| 26 | S23 | TS, WA | | | " " " | |
| 27 | S24 | TS, WA | | | " " " | |
| 28 | S25 | TS, WA | | | " " " | |
| 29 | S28 | TS, WA | | | " " " | |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41530 | S29 | TS, WA | | see Figure IX | |
| 31 | S30 | TS, WA | | " " | " |
| 32 | S31 | TS | | " " | " |
| 33 | S32 | TS, WA | | " " | " |
| 34 | S33 | TS, WA | | " " | " |
| 35 | S34 | TS, WA | | " " | " |
| 36 | S35 | TS, WA | | " " | " |
| 37 | S38 | TS, WA | | " " | " |
| 38 | S41 | TS, WA | | " " | " |
| 39 | S37 | TS, WA | | " " | " |
| 40 | S39 | TS, WA | | " " | " |
| 41 | S40 | TS, WA | | " " | " |
| 42 | S8 | TS | | " " | " |
| 43 | S9 | TS, WA | | " " | " |
| 44 | S15 | TS | | " " | " |
| 45 | S18 | TS | | " " | " |
| 46 | S19 | TS, WA | | " " | " |
| 47 | S20 | TS | | " " | " |
| 48 | S43 | | | " " | " |
| 49 | S44 | | | " " | " |
| 50 | S92 | TS, WA | approx. | 3412 | 7700 |
| 51 | S93 | TS | " | 3412 | 7700 |
| 52 | S94 | TS | " | 3412 | 7700 |
| 53 | S14 | PB | | see Figure IX | |
| 54 | S17 | TS, 2PB | | " " | " |
| 55 | S21 | TS | | " " | " |
| 56 | S36 | TS | | " " | " |
| 57 | S45 | TS | | " " | " |
| 58 | S46 | TS | | " " | " |
| 59 | S47 | | | " " | " |
| 60 | S48 | | | " " | " |
| 61 | S49 | | | " " | " |
| 62 | S91 | TS | approx. | 3412 | 7702 |
| 63 | | B.H.P. road | " | 3475 | 7674 |
| 64 | S96 | TS | " | 3409 | 7737 |
| 65 | S97 | TS | " | 3409 | 7737 |
| 66 | S98 | TS | " | 3390 | 7750 |
| 67 | S103 | TS, WA | | see Figure X | |
| 68 | S104 | TS | | " " | " |

| Department Number | Field Number | Treatment | | Easting | Northing |
|---|---|---|---|---|---|
| 41569 | S105 | TS, WA | | see Figure X | |
| 70 | S106 | TS, WA | | " " | " |
| 71 | S107 | TS, WA | | " " | " |
| 72 | S110 | 3TS, WA | | " " | " |
| 73 | S100 | TS | | " " | " |
| 74 | S102 | TS | | " " | " |
| 75 | S109 | TS, WA | | " " | " |
| 76 | S101 | TS | | " " | " |
| 77 | S108 | | | " " | " |
| 78 | S111 | | | " " | " |
| 79 | S112 | | | " " | " |
| 80 | S113 | | | " " | " |
| | | | | | |
| 41752 | P1 | TS | Prince Darwin grid | 10000 N, | 4300 E |
| 41753 | P5 | TS | " " " | 10000 N, | 4490 E |
| 41754 | Y37 | TS | | 3604 | 8145 |

FIGURE VI. Generalized geology of Prince Darwin showing sample locations.



Prince Darwin DDH-1
inclined west at 45°
Specimen Number
Depth (metres)
41121 12 8
41120 29 0
41116 29 6
41119 43 6
41118 46 3
41117 56 7
41115 76 2
41122 85 0
41128 91.1
41129 96 9
41130 104 9
41131 132 3
41132 143 6
41133 146 0
41134 176 8
41135 187.1
41136 194.2
41138 194 9
41137 197 2
41139 197 2
41140 198 4
Grid origin at
360 000yE 790 000yN
(Australian Map Grid)
Prince Darwin DDH-2
inclined east at 45°
Specimen Number
Depth (metres)
41141 18 6
41142 86 3
41143 103.0
41144 106.4
41145 113 4
41146 117 3
41147 143 6
41148 158.8
probable fault
Prince Darwin Adit
16000 feet
15000
14000
13000
12000
11000
10000
9000
8000 feet
4000 feet
5000
6000
7000
8000 feet
0 metres 400
Darwin Granite
Undifferentiated Volcanics - lavas and tuffs
Massive rhyolite with veined and disseminated magnetite-hematite
Bipyramidal quartz porphyry lava
Drill site Prince Darwin DDH-1 and 2
N
41114
41113
41112
41111
41110
41124
41123
41125
41090
41092
41094
41091
41093
41095
41097
41098
41100
41099
41101
41102
41103
41104
41087
41088
41086
41089

FIGURE VII. East Darwin Area showing locations of tracks, trenches and adits.

M = Mount Darwin Pty. adit

P = Pearces adit

D1 = Dillons No. 1 adit

D2 = Dillons No. 2 adit

S = Souters adit

A = "small un-named adit"

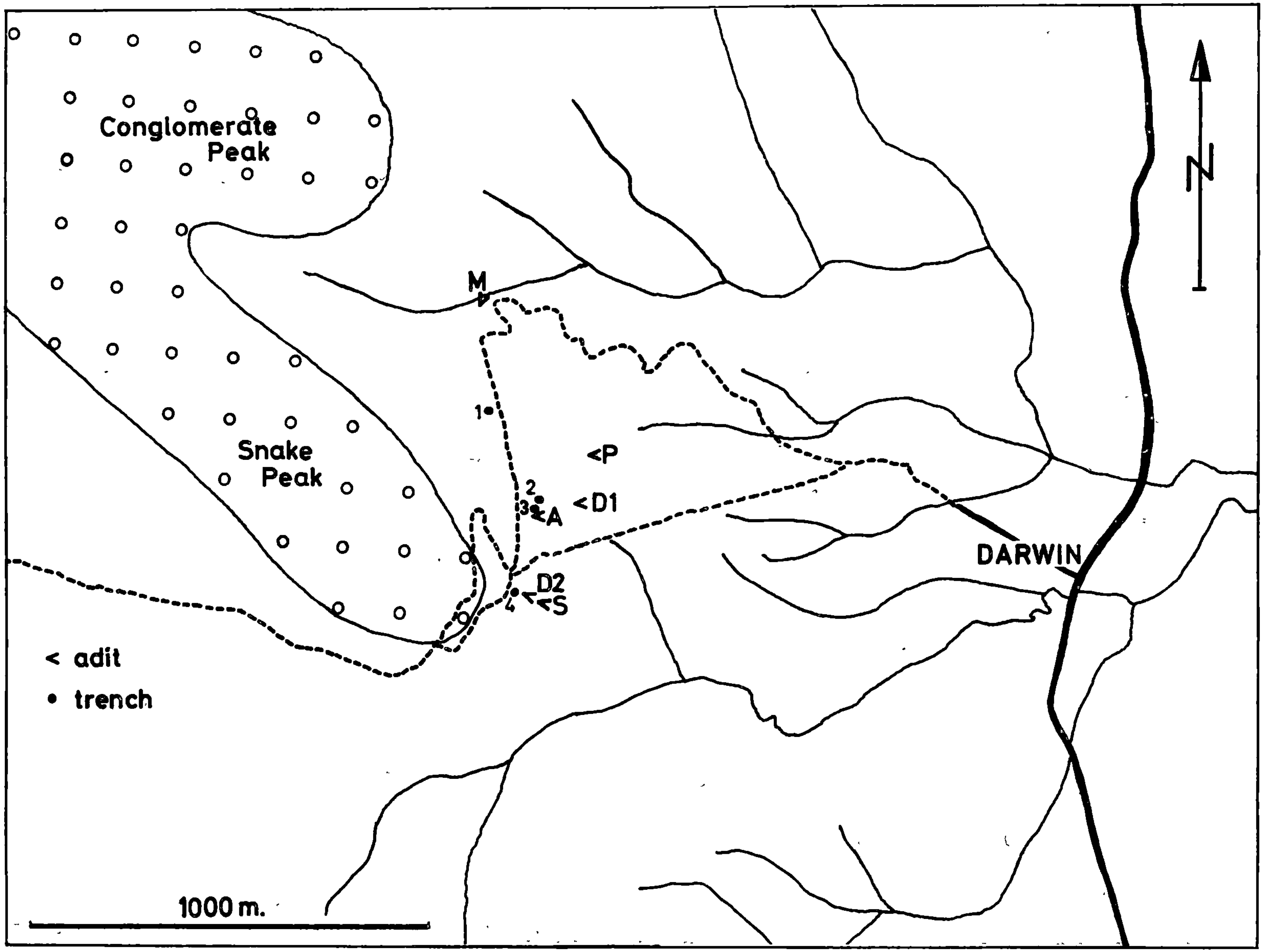

N
Conglomerate Peak
Snake Peak
M
1
2
3
4
<P
<D1
A
D2
S
DARWIN
< adit
• trench
1000 m.

FIGURE VIII. Map showing locations of samples along the Lyell Highway near Queenstown and nearby.

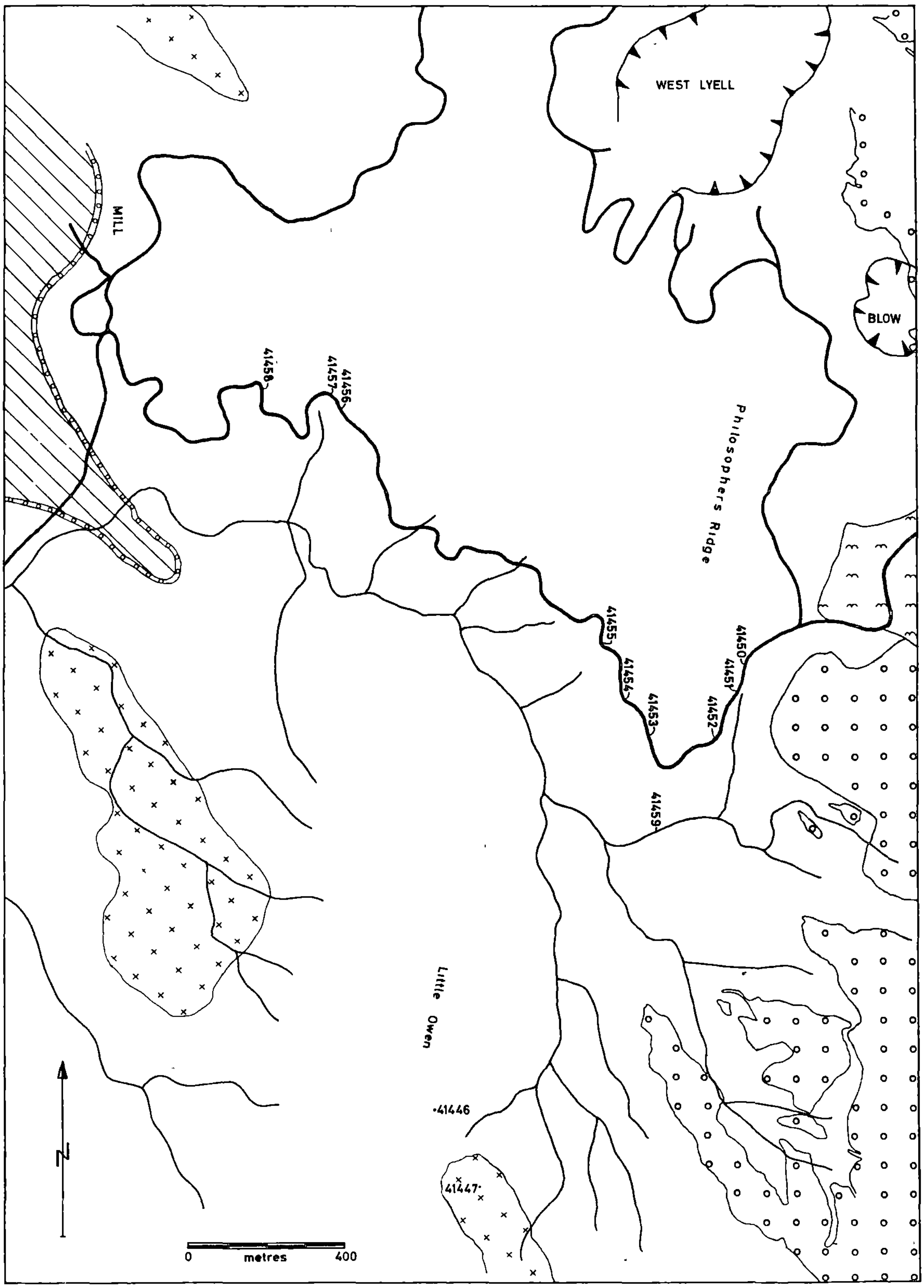
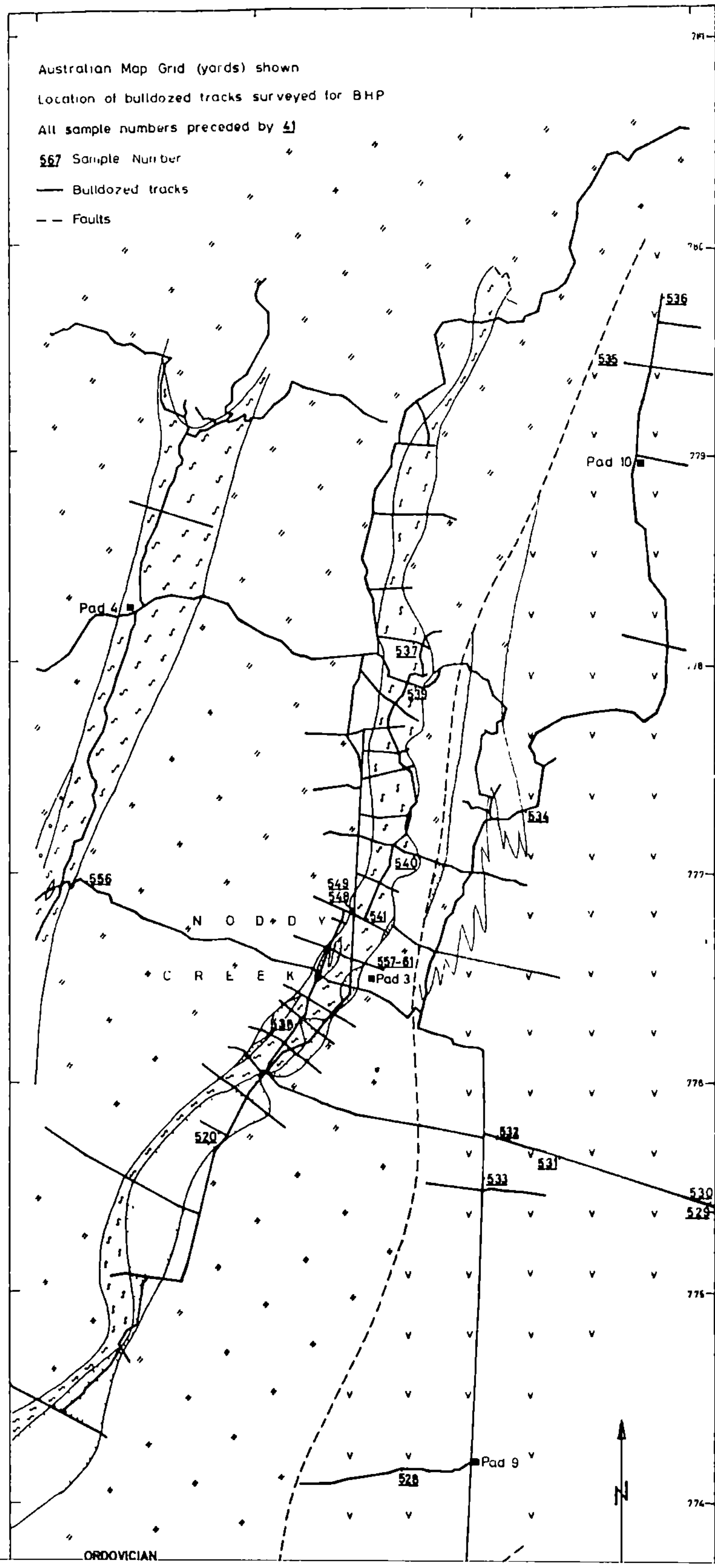

WEST LYELL
BLOW
MILL
Philosophers Ridge
Little Owen
41458
41457
41456
41455
41454
41453
41452
41451
41450
41459
41446
41447
N
0
metres
400

FIGURE IX. Map of the Noddy Creek-Timbertops area showing bulldozed tracks and sample locations.



Australian Map Grid (yards) shown
Location of bulldozed tracks surveyed for BHP
All sample numbers preceded by 41
567 Sample Number
Bulldozed tracks
Faults
Pad 4
Pad 10
Pad 3
Pad 9
536
535
537
539
534
540
549
548
541
557-61
556
538
520
532
531
533
530
529
528
N O D D Y
C R E E K
N
ORDOVICIAN

FIGURE X. Sample locations in the Double Cove area.

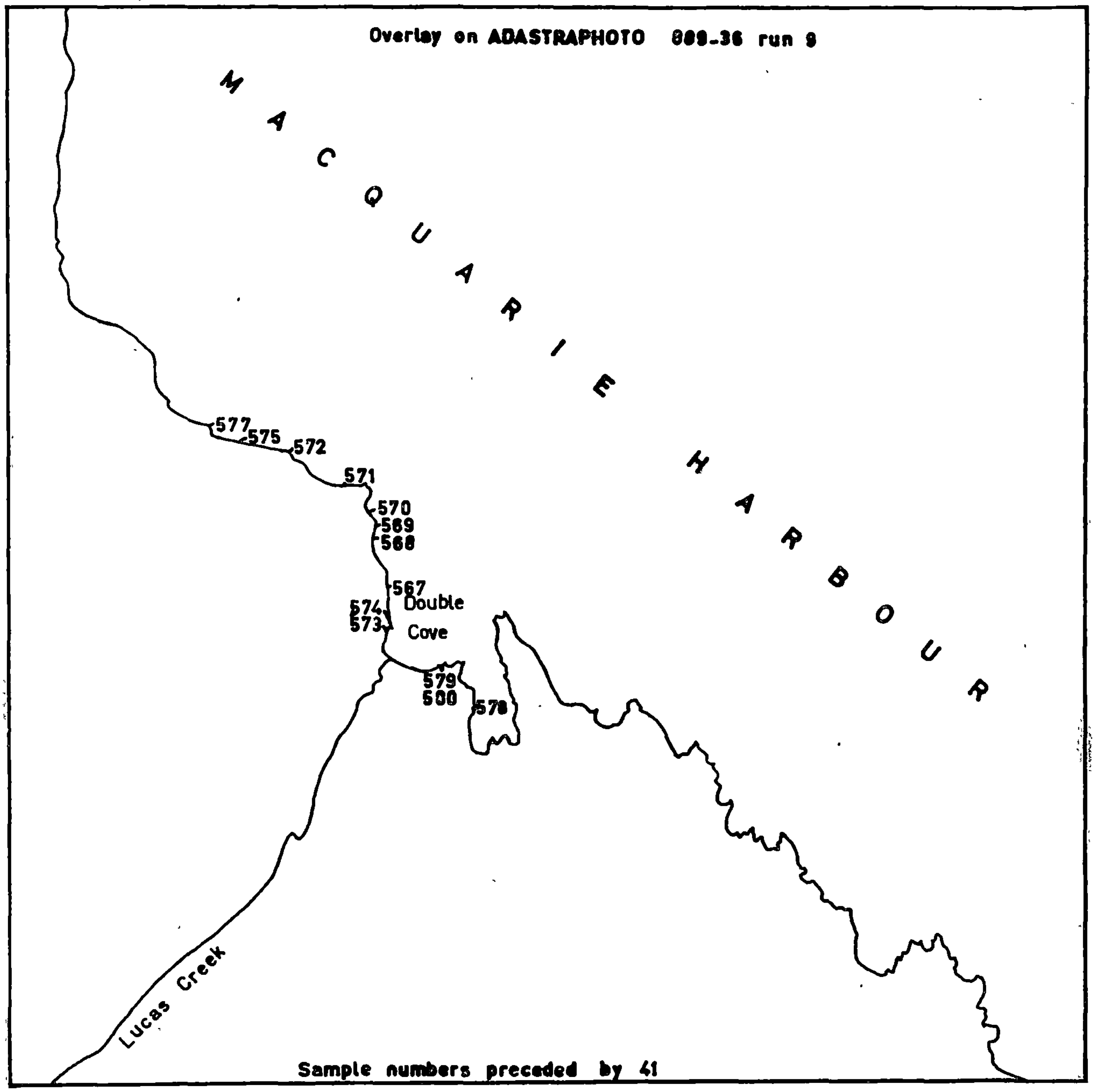

Overlay on ADASTRAPHOTO 889-36 run 9
MACQUARIE HARBOUR
577
575
572
571
570
569
568
567
574
573
Double
Cove
579
580
578
Lucas Creek
Sample numbers preceded by 41

Plate 1. Aerial view from the south-east of part of the Jukes-Darwin area. The bare mass on the left is Mount Darwin. Mount Jukes forms the broad mountain below the wing. Mounts Huxley and Owen are faintly visible in the distance.

Plate 2. View from Mount Sorell across the Clark Valley to the Darwin Plateau and South Darwin Peak. The boundary between Intercolonial Volcanics and Clark Volcanics can be seen along the slope opposite. The rock in the foreground is Owen Conglomerate, dipping west.

Plate 3. View looking south-east across Elliott Bay. Note the gentle topography. Most outcrop is confined to the shores of the Bay. The hills in the background are composed of Precambrian rocks of the Tyennan Block.

Plate 4. Aerial view looking north along Birch Inlet (centre right). The Noddy Creek area includes the densely vegetated area occupying the left of the photograph. Mount Sorell is the highest peak visible in the distance on the right.

Plate 5. Clasts of pink Darwin Granite in pyroclastics of the Andrew Volcanics near their non-conformable contact east of the Darwin Plateau. The lens cap is 5 cm in diameter.

Plate 6. Flow structure in a massive rhyolite of the Intercolonial Volcanics, Prince Darwin.


ASAHI
PENTAX

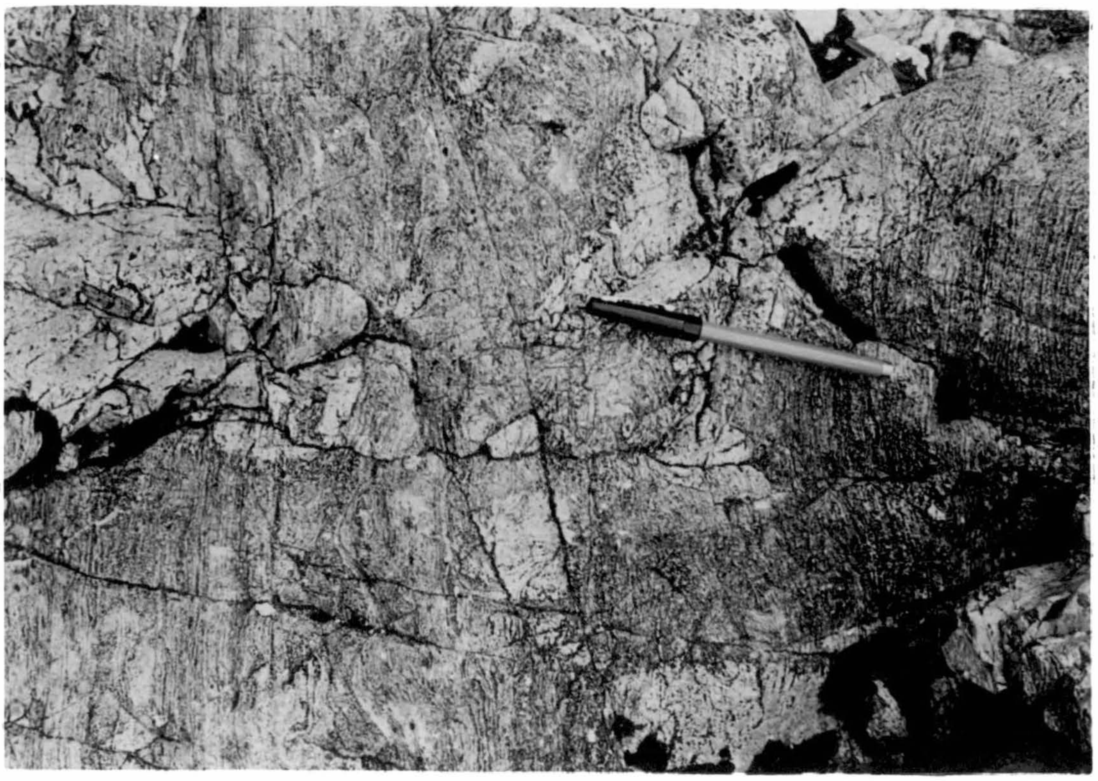


Plate 7. Volcanic breccia, Adit Knob, North Lake Jukes. The angular clasts show little lithological variation.

Plate 8. Volcanic conglomerate, King River Gorge. The clasts which are composed of volcanics of diverse lithology, are strongly attenuated in the cleavage. Most were probably originally rounded. The matrix is tuffaceous.

Plate 9. Kinking in strongly cleaved volcanic ash at Darwin townsite where it is interbedded with tuff at the top of the exposed sequence of Andrew Volcanics. The lens cap is 5 cm in diameter.

Plate 10. Contact between Jukes Conglomerate and Intercolonial Volcanics, north Mount Jukes. The head of the hammer lies along the contact between massive rhyolites of the Intercolonial Volcanics, and coarse Jukes Conglomerate consisting of clasts of the underlying rhyolite.


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Plate 11. Contact between Owen Conglomerate and Intercolonial Volcanics, north Mount Jukes. Here the highly lenticular Jukes Conglomerate is absent, and the Owen Conglomerate rests directly on massive rhyolites.

Plate 12. Contact between Jukes and Owen Conglomerates, South Darwin Peak. The sudden appearance of coarse quartzite clasts marks a dramatic change in the sedimentation. Mixing of volcanic and quartzite clasts occurs over an interval of about one metre, above which volcanics are entirely absent.

Plate 13. Trough structure in a fine-grained phase of the Jukes Conglomerate, north Mount Huxley.

Plate 14. Hematitic-breccia clast in Jukes Conglomerate, South Darwin Peak. Identical material occurs as veins in Intercolonial Volcanics nearby.

Plate 15. Graded tuff sequence, Whip Spur. The finely laminated top of one unit can be seen to be abruptly overlain by the coarse base of the next unit, which itself grades upwards into a finely laminated top.

Plate 16. Graded tuff sequence, Whip Spur. Erosion of the top of the previous unit during deposition of the coarse basal tuff is indicated by the 5 cm interval which is upturned and broken off left of the hammer.

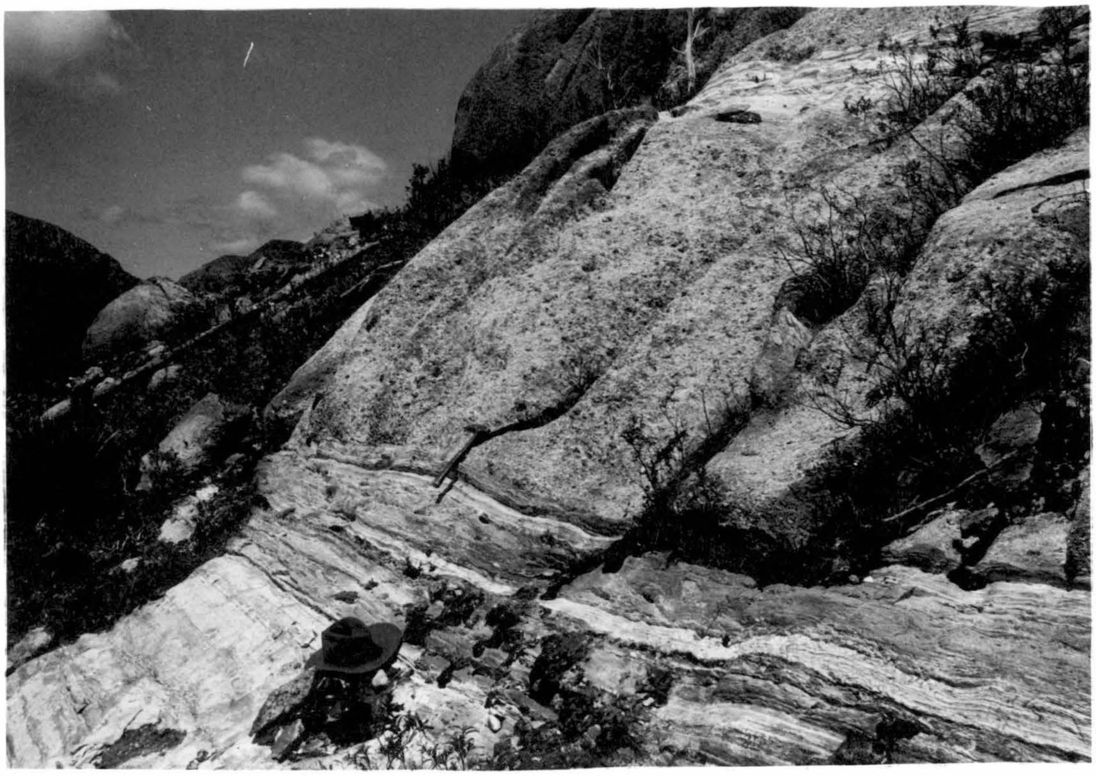

Plate 17. Detail of the contact between two units of the graded tuff sequence, Whip Spur. The clasts in the upper unit are up to about 2 cm diameter. Note slight ripples in the upper surface of the lower unit are undisturbed by the coarse overlying material.

Plate 18. Graded tuff sequence, Whip Spur. Soft-sediment slump folds in laminated volcanic ash which forms the top of one unit. Note subsequent ash deposition is undisturbed. The lens cap is 5 cm in diameter.

Plate 19. Trough-shaped biotite accumulation in coarse porphyritic granite of the Low Rocky Point Pluton.

Plate 20. Irregular flow-banded rhyolite dyke in medium-grained adamellite, Low Rocky Point.

Plate 21. Fold cropping out on the beach at the mouth of Sassy Creek. Note the hook-shaped fold closure below the point of the hammer.

Plate 22. Kink band in laminated siltstones at the mouth of Sassy Creek.

Plate 23. Spaced cleavage in laminated dolomitic siltstones at the mouth of Sassy Creek.

Plate 24. Folded quartz veins in tuffs about one kilometer north of the mouth of the Lewis River. In places a second generation of quartz veins and gashes which post-date the folding may be present.

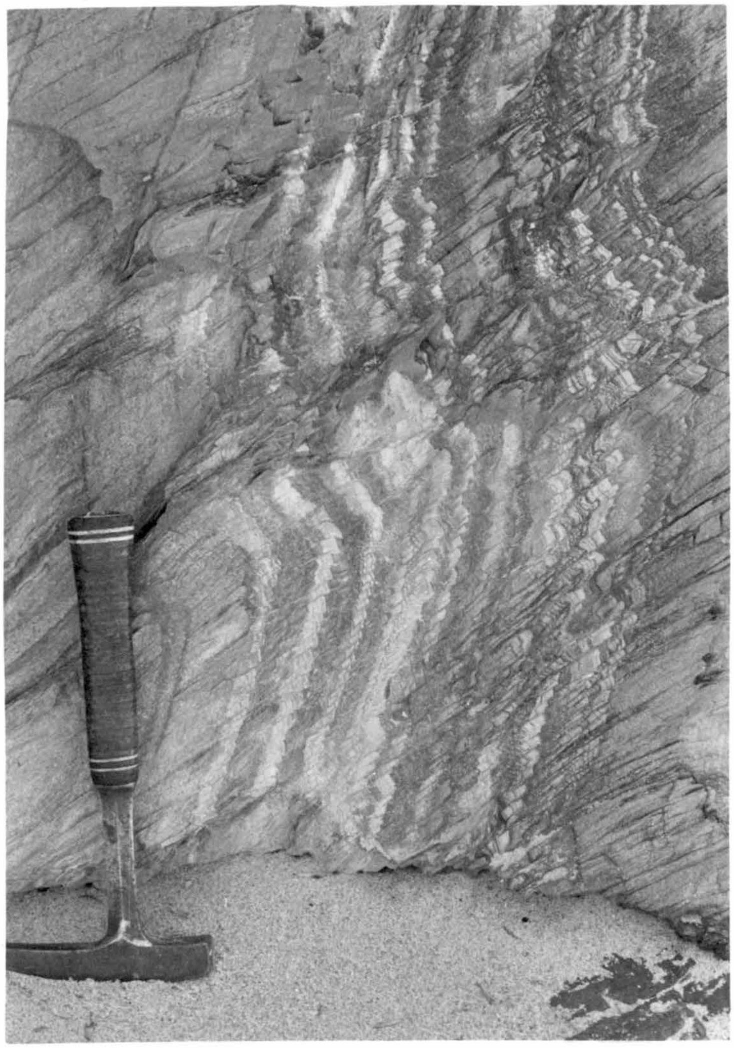

Plate 25. Conglomerate in Dundas Group at Noddy Creek. The clasts are dominantly chert and silicified argillites. The lens cap is 5 cm in diameter.

Plate 26. Laminated siltstone showing small-scale current bedding passes upwards into intraformational brecciation. These sediments occur interbedded with massive spilites of the Lucas Creek volcanics.


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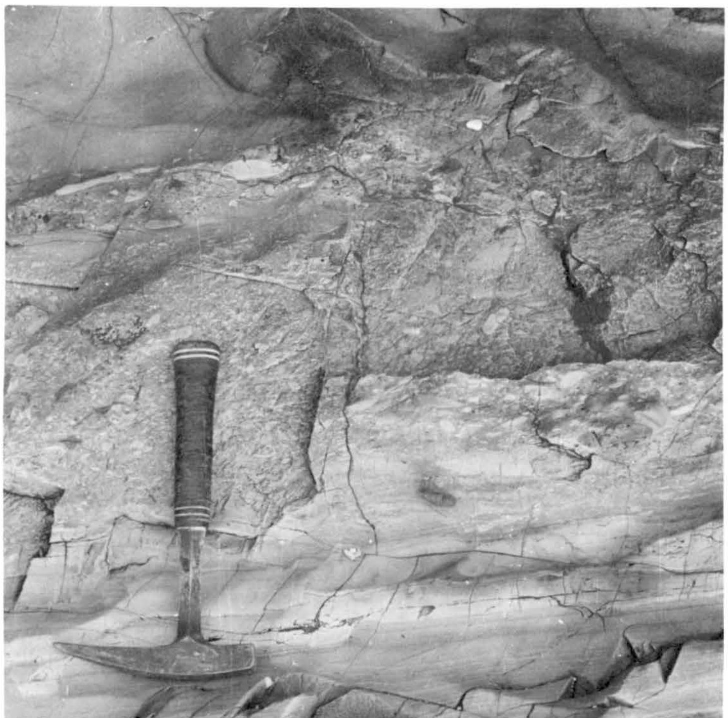

Plate 27. Laminated sediments (left) in contact with massive spilitic tuffs (right) of the Lucas Creek volcanics. Plate 26 was photographed at the far left of the field.

Plate 28. Coarse-grained spilite breccia of the Lucas Creek volcanics exposed on the shores of Macquarie Harbour.

Plate 29. A well-preserved pillow in spilites near the base of the Lucas Creek volcanics.

Plate 30. End-view of the same pillow as shown in Plate 29. Note the fine-grained chilled margins.

Plate 31. Isoclinal folding in sediments exposed at Double Cove. In this case the fold axis has been faulted producing a disrupted core.

Plate 32. Folding in sediments at Double Cove. The outcrop shown has been produced by faulting parallel to one limb of the fold.

Plate 33. Small refolded fold in sediments at Double Cove.

Plate 34. Chevron-style folds in sediments at Double Cove.

Plate 35. Cleavage development in sediments, Double Cove.

Plate 36. Closely jointed bedding planes in arenite beds, Double Cove. Slaty cleavage is developed in the interbedded argillites. The lens cap is 5 cm in diameter.


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Plate 37. Finely layered vitric tuff adjacent to the pack-track to East Darwin. Scale is indicated by a match, 4.5 cm in length.

Plate 38. Volcanic breccia in the mineralized zone at East Darwin. Petrographic examination of the matrix indicates an ash-flow origin.

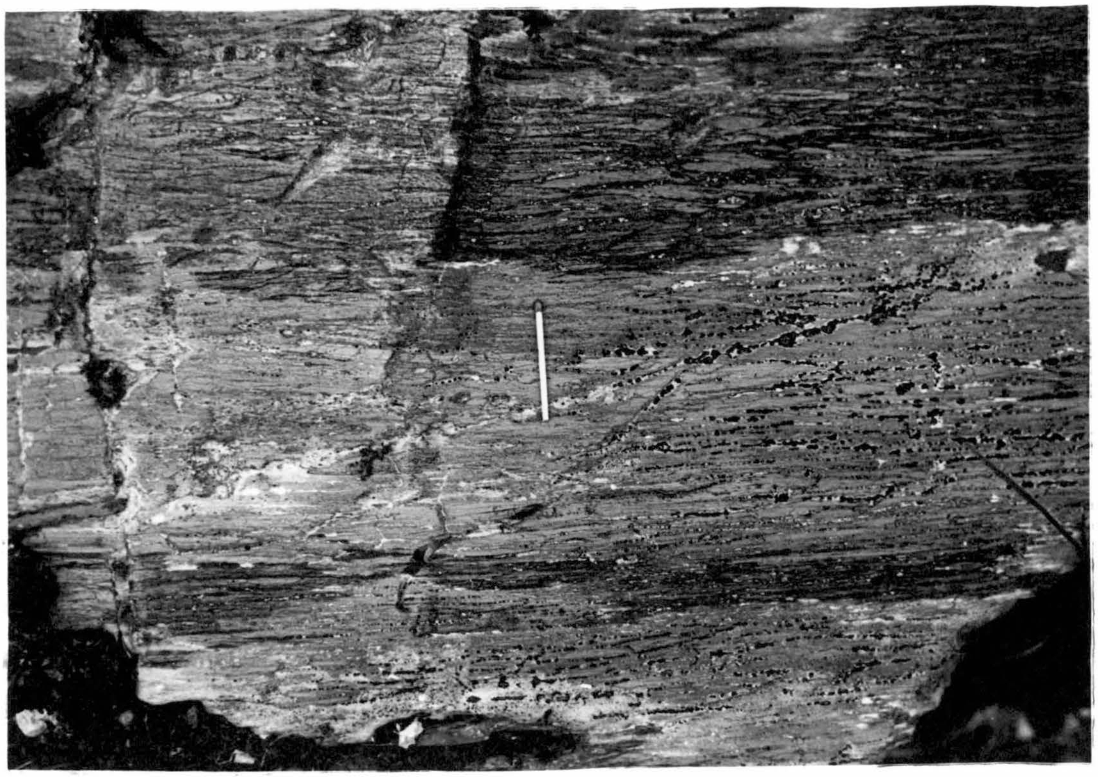


Plate 39. Termination of probable pumice fragment ("fiamme") in an ignimbrite from East Darwin. Specimen 41262; magnification: x40.

Plate 40. Spindle shaped volcanic bombs in pyroclastic deposits near the southern end of Intercolonial Spur. Note also the abundant lapilli-sized fragments.

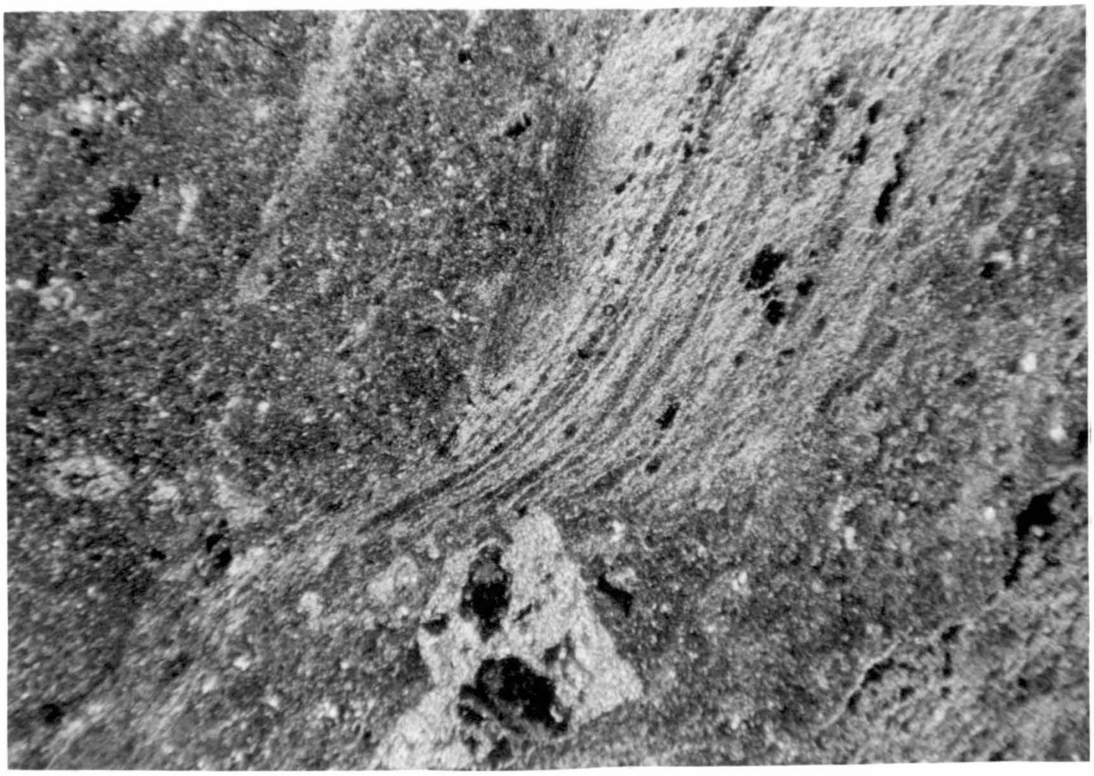
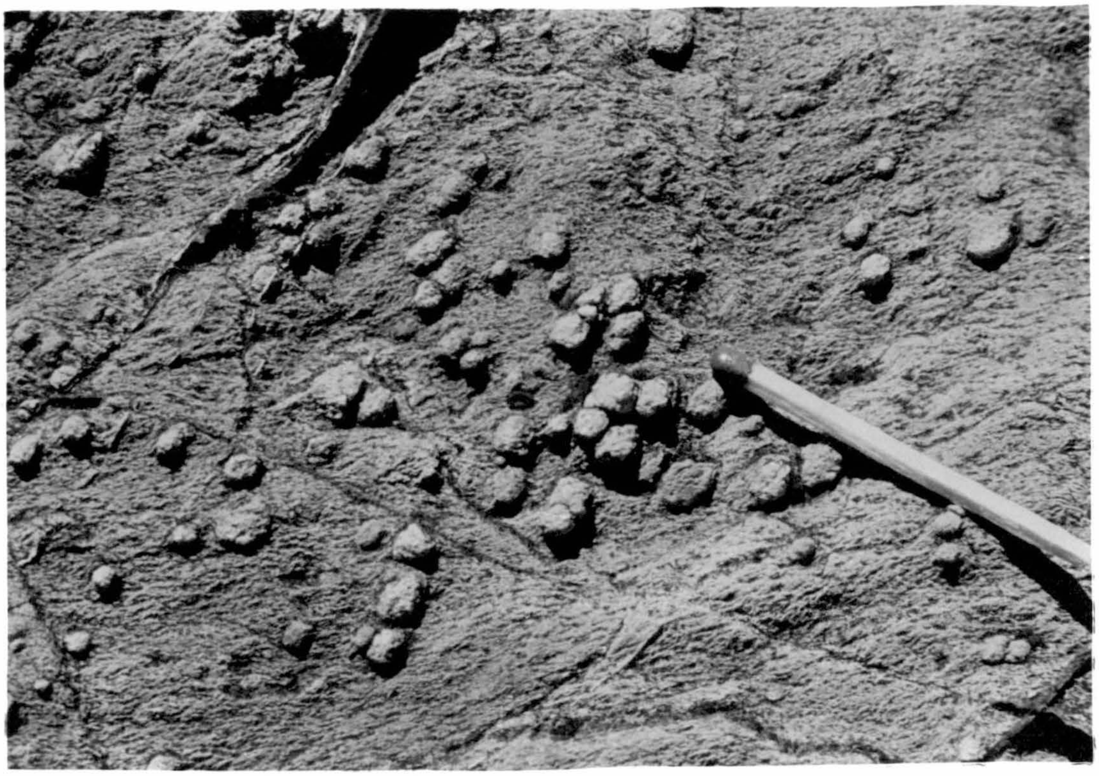
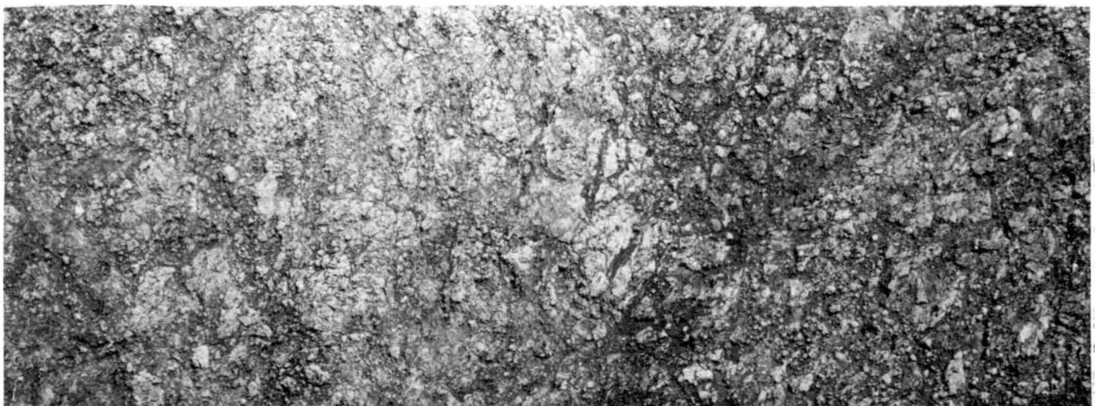


Plate 41. Probable lapilli in tuffs near the southern end of Intercolonial Spur. In some cases they are concentrated in layers.

Plate 42. Chloritic crystal-lithic tuff or fine breccia, the host-rock for mineralization at Hydes prospect.





The following six pairs of plates illustrate gradations in the degree of development of micropoikilitic or "snowflake" texture.

In all cases

a) (left) plane polarised light

b) (right) same field, crossed nicols.

Magnification is the same in all cases

magnification: x40.

<u>Plate 43.</u> Weak development, no significant segregation in a).

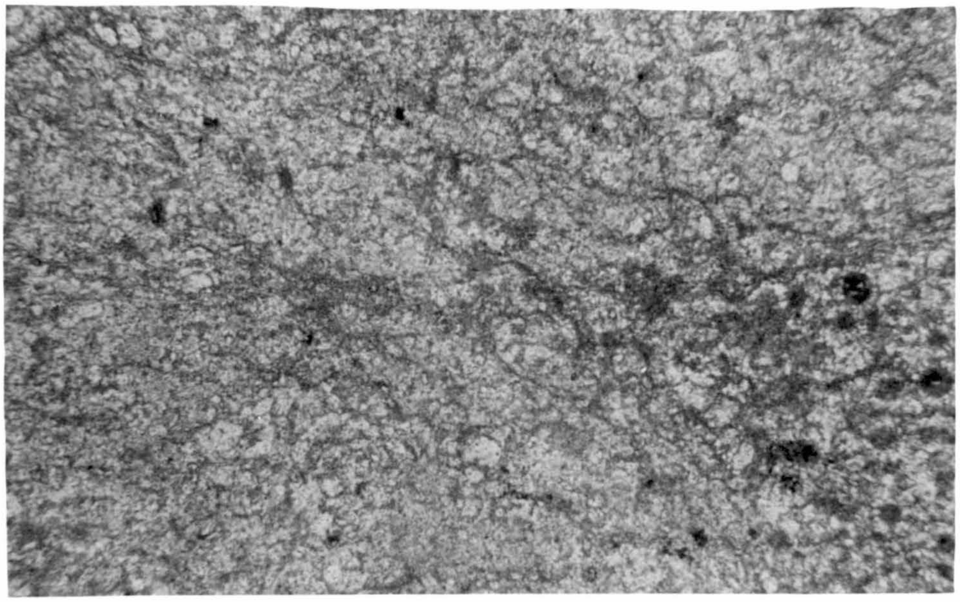
<u>Plate 44.</u> Moderate development, distinct segregation in a), clear extinction in b).

<u>Plate 45.</u> Strong development with quartz cores, coarse segregation in a).

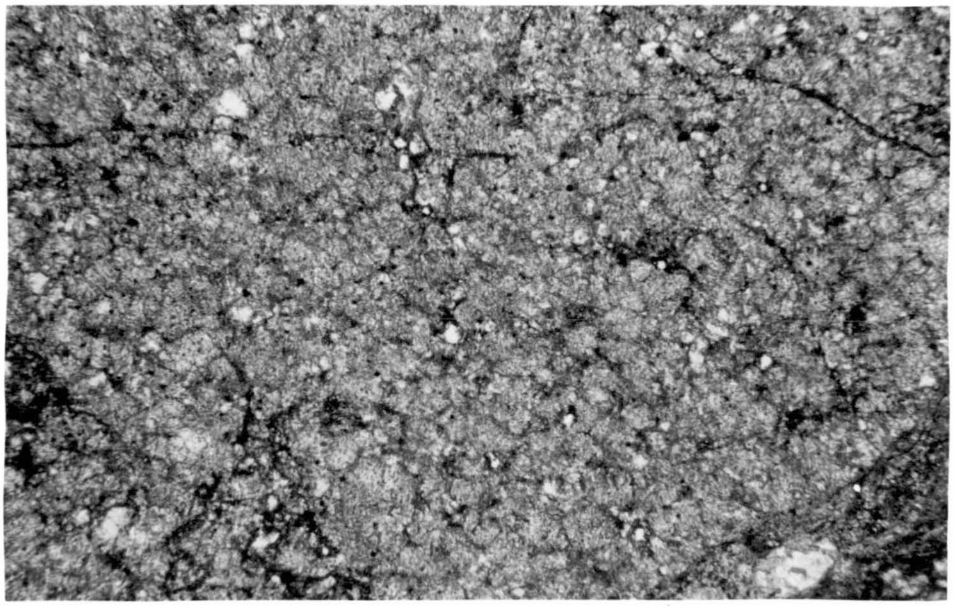
<u>Plate 46.</u> Very strong development with skeletal quartz cores transitional to granophyric texture (c.f. Plate 48) and distinct segregation with sharp extinction.

<u>Plate 47.</u> Extreme "quartzite" development. Note by contrast with previous examples a) shows relatively minor segregation and quartz cores largely absent, yet b) shows coarse, extremely sharp extinction. Specimen 41213.

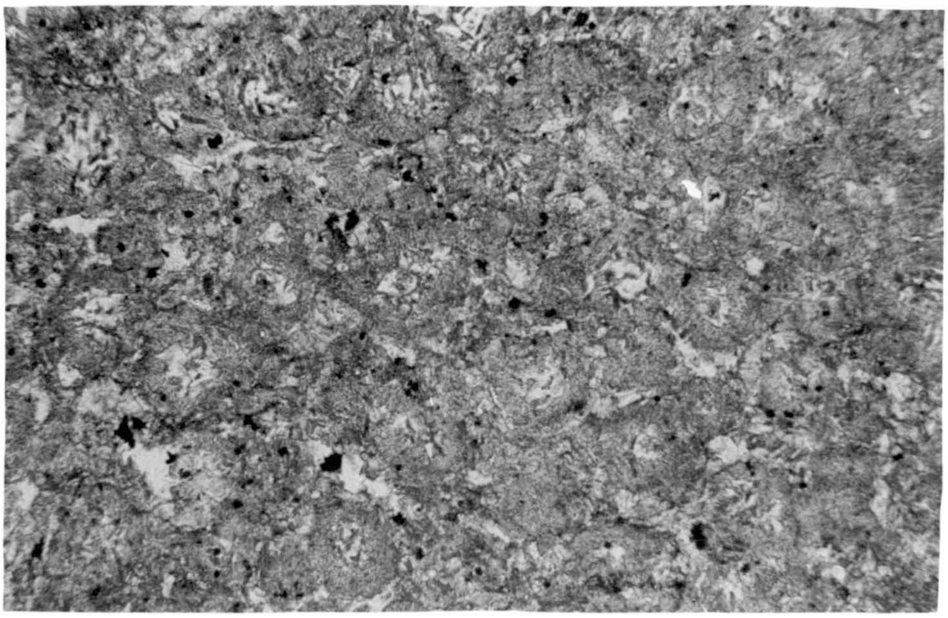
<u>Plate 48.</u> Granophyric texture apparently represents a more extreme form of the snowflake texture shown in Plate 46. B.H.P. Slide F36 from Adit Knob, North Lake Jukes.



43a).

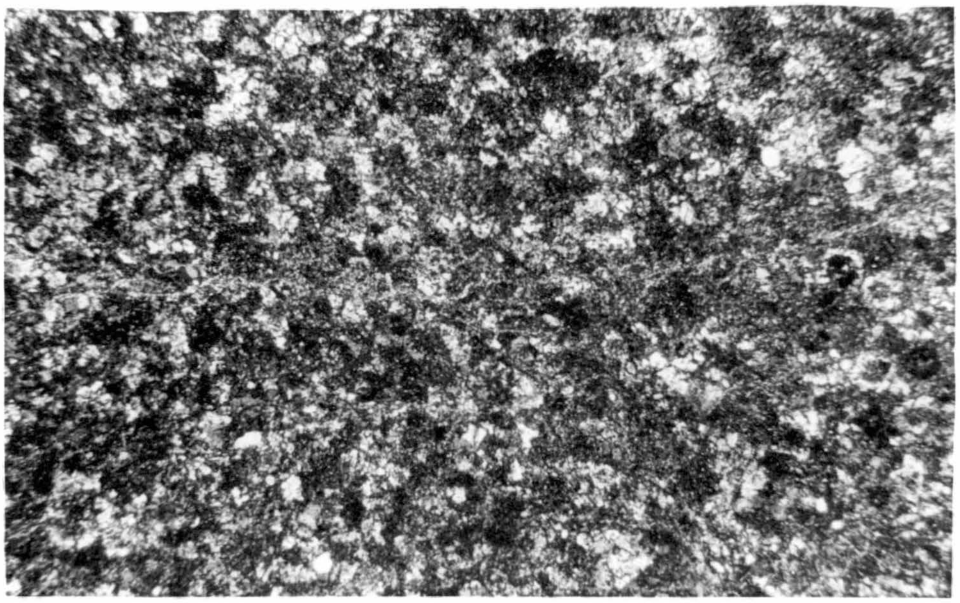


44a).

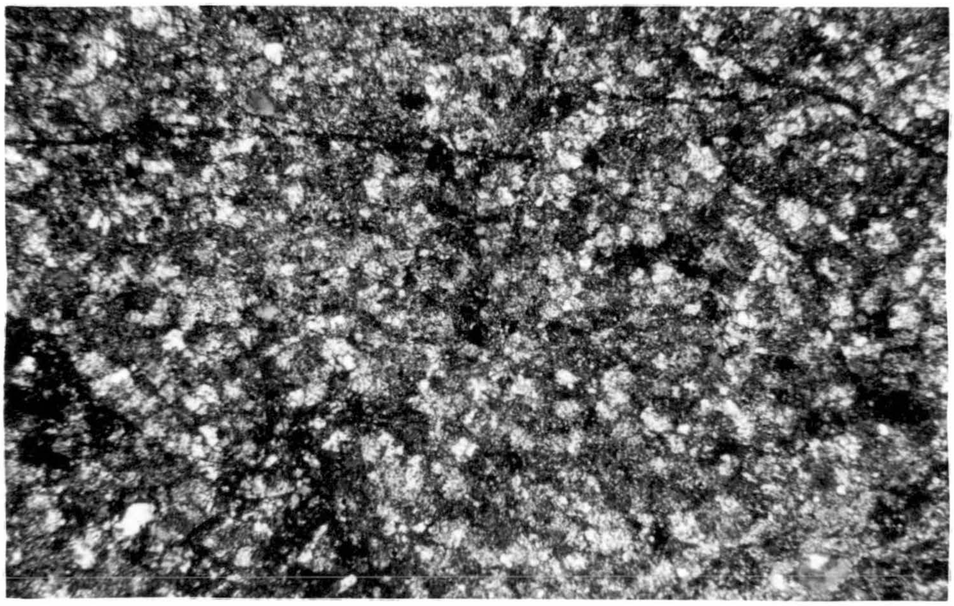


45a).

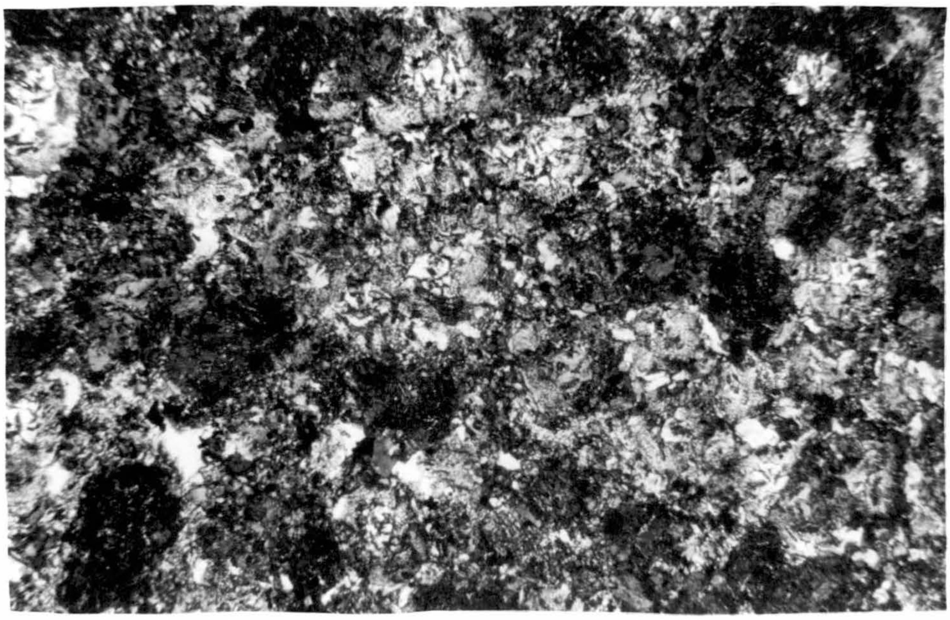
43b).

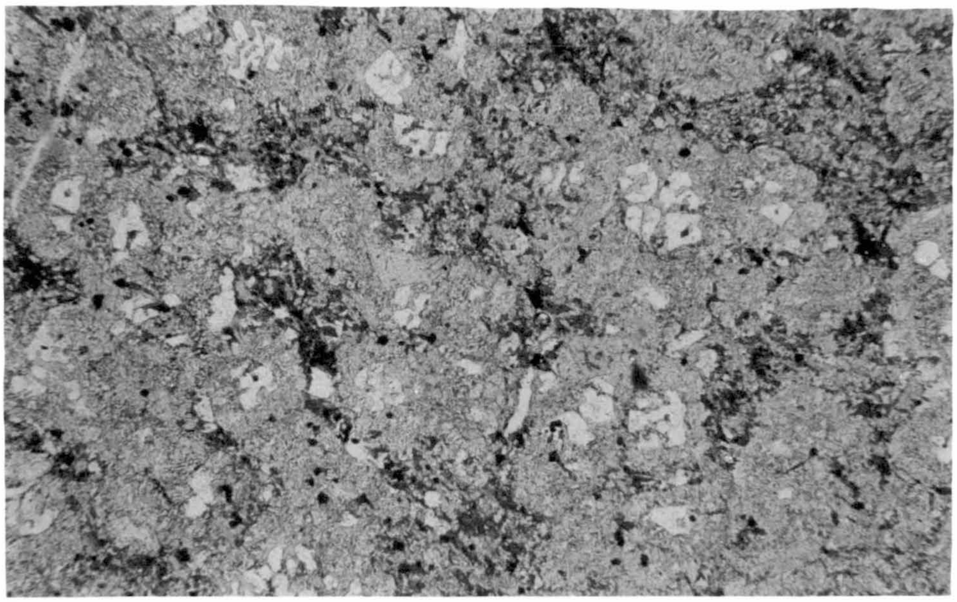


44b).

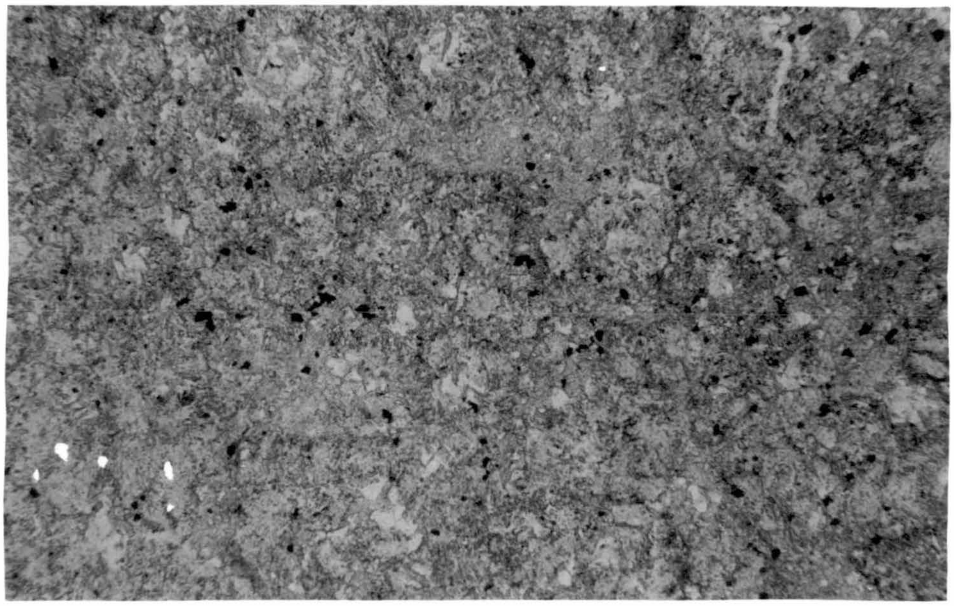


45b).

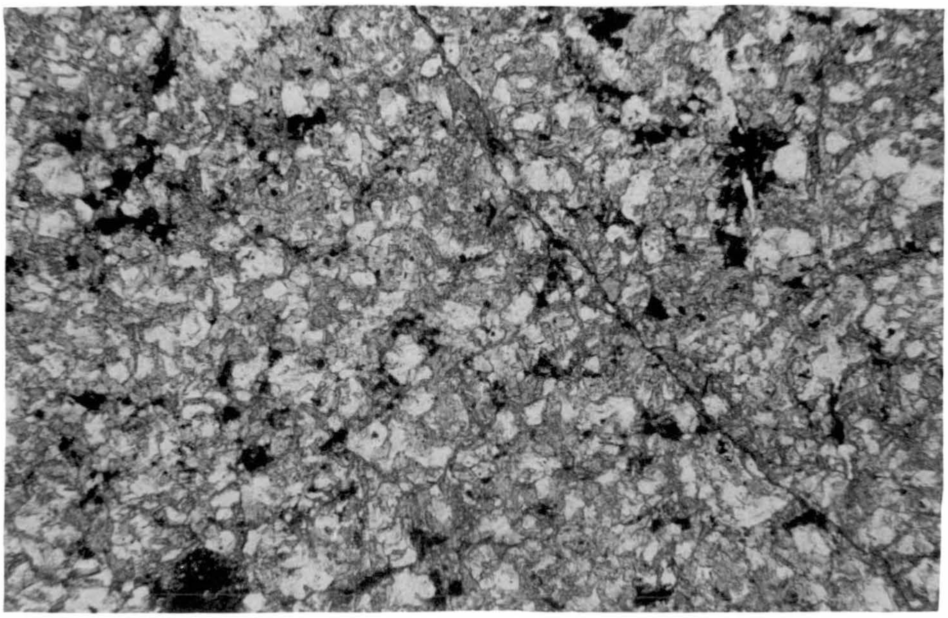




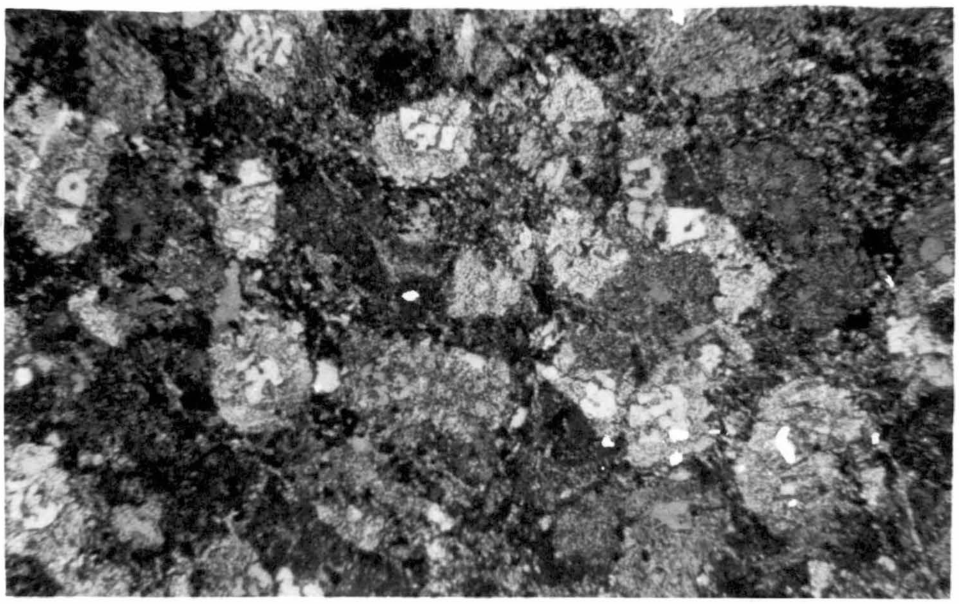
46a).



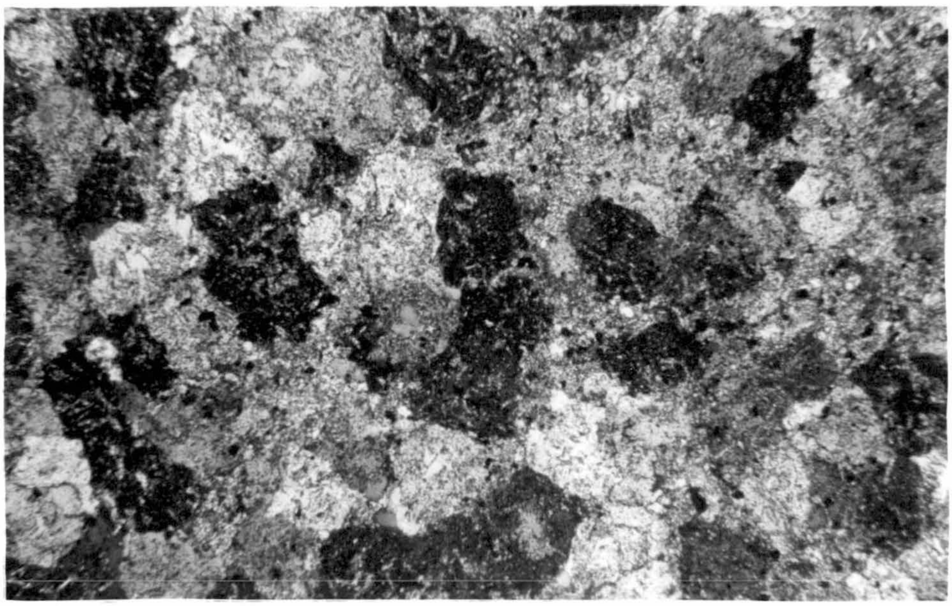
47a).



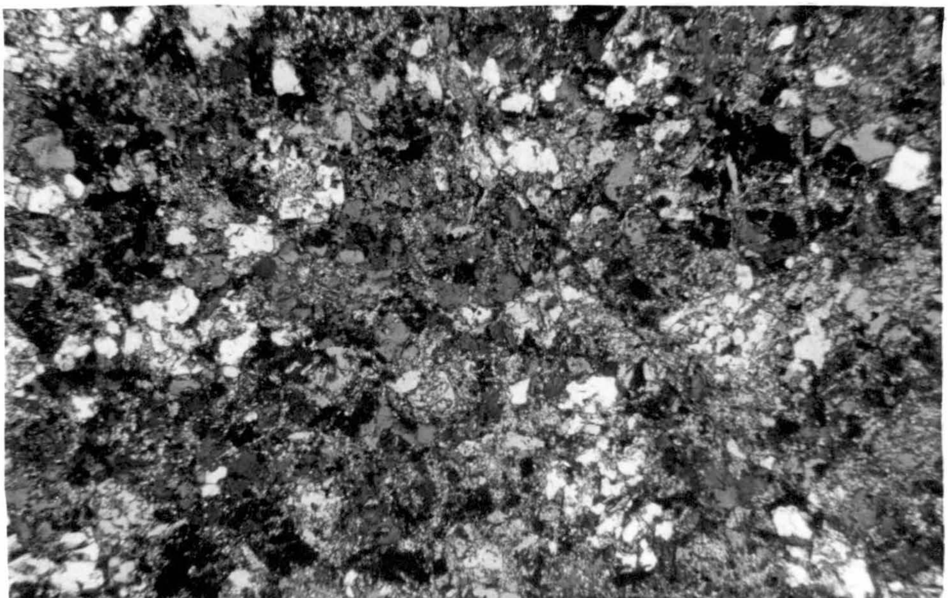
48a).



46b).



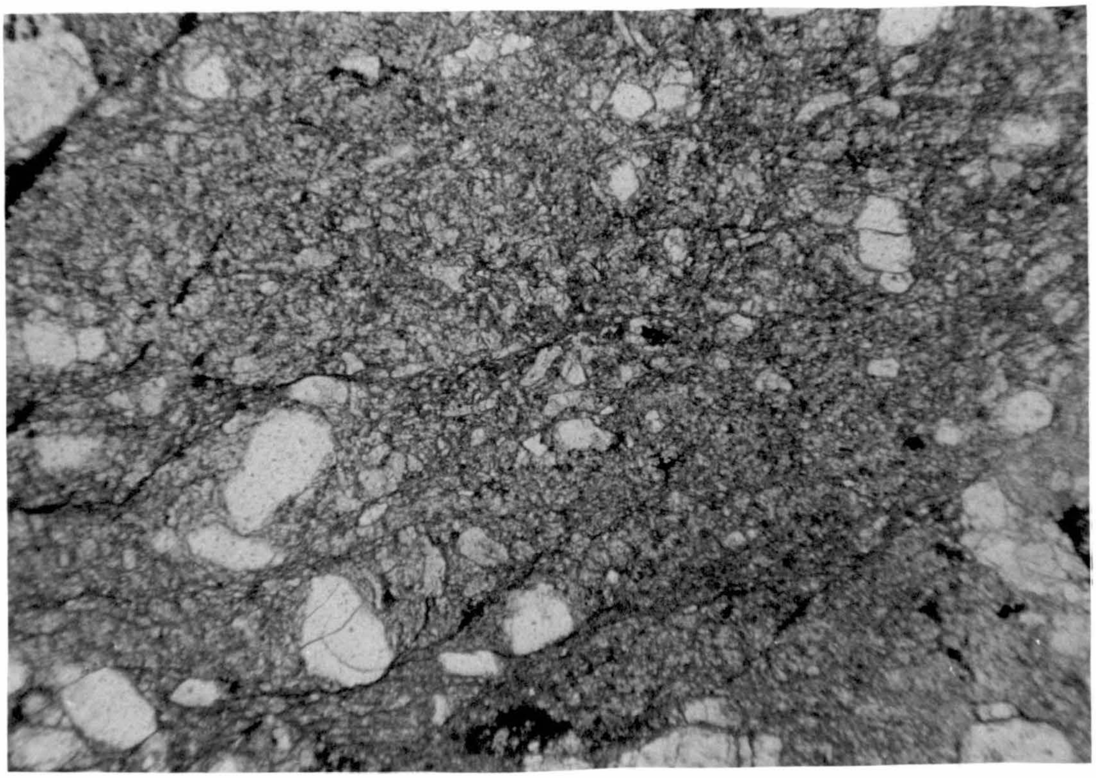
47b).



48b).

Plate 49. Crystal-vitric tuff containing undeformed broken glass shards and crystal fragments. Specimen 41171 from the summit of Mount Darwin. Magnification: x40.

Plate 50. Rounded quartzite clast in a crudely bedded tuffaceous matrix. Specimen 41371 from the Andrew Volcanics, King River Gorge.



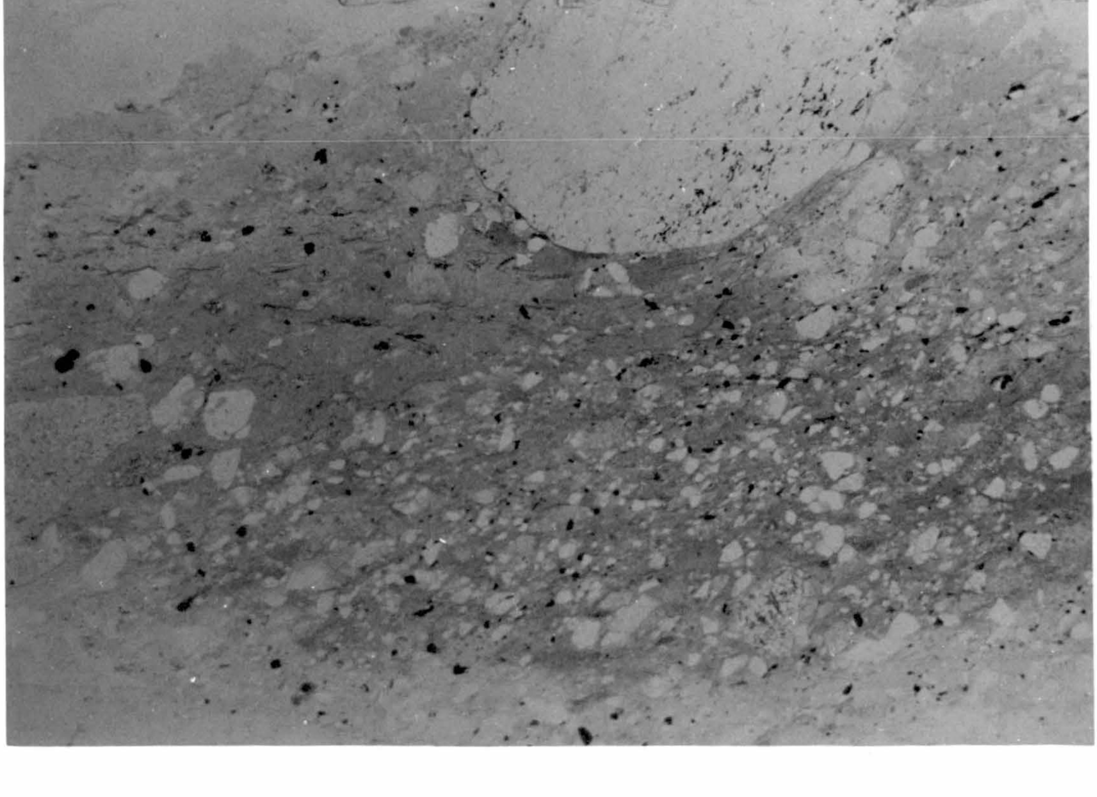
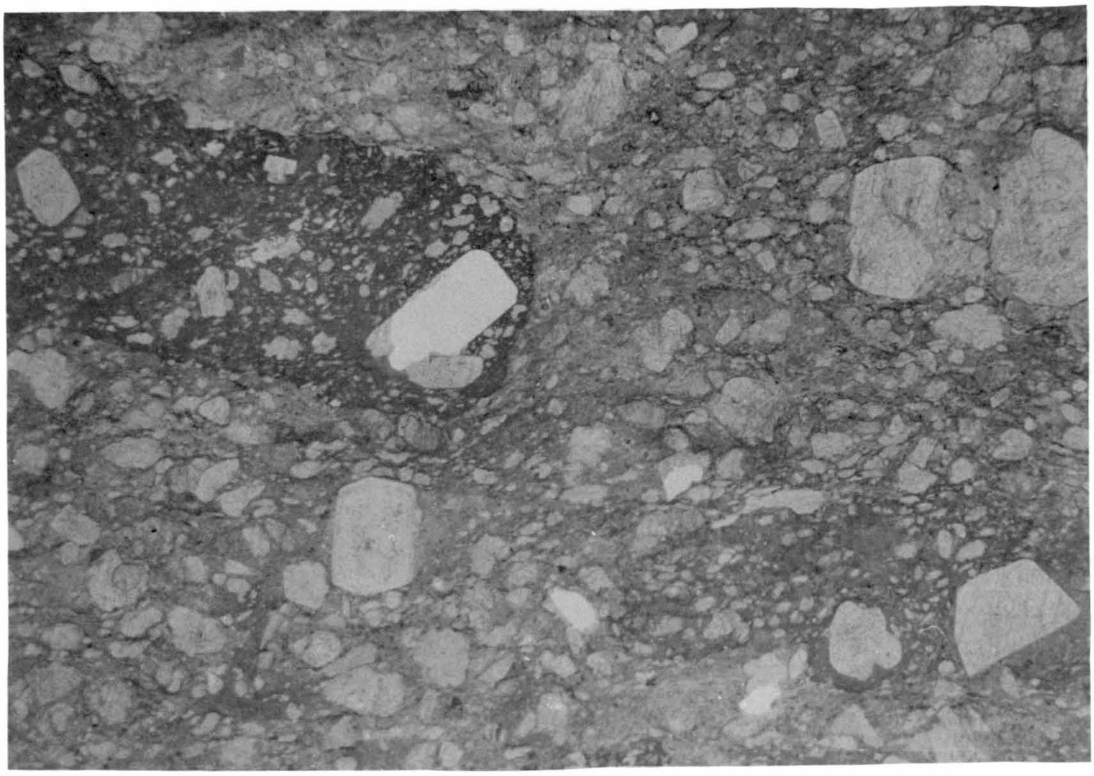


Plate 51. Basaltic tuff, Lynch Creek. The coarse euhedral crystals are fresh augite. The clear area is a hole resulting from removal of an augite crystal during grinding. Specimen 41460; magnification: x40.

Plate 52. Crystal tuff. The field contains albite, augite, and minor opaques. Note the virtual absence of matrix. Specimen 41431; magnification: x50.



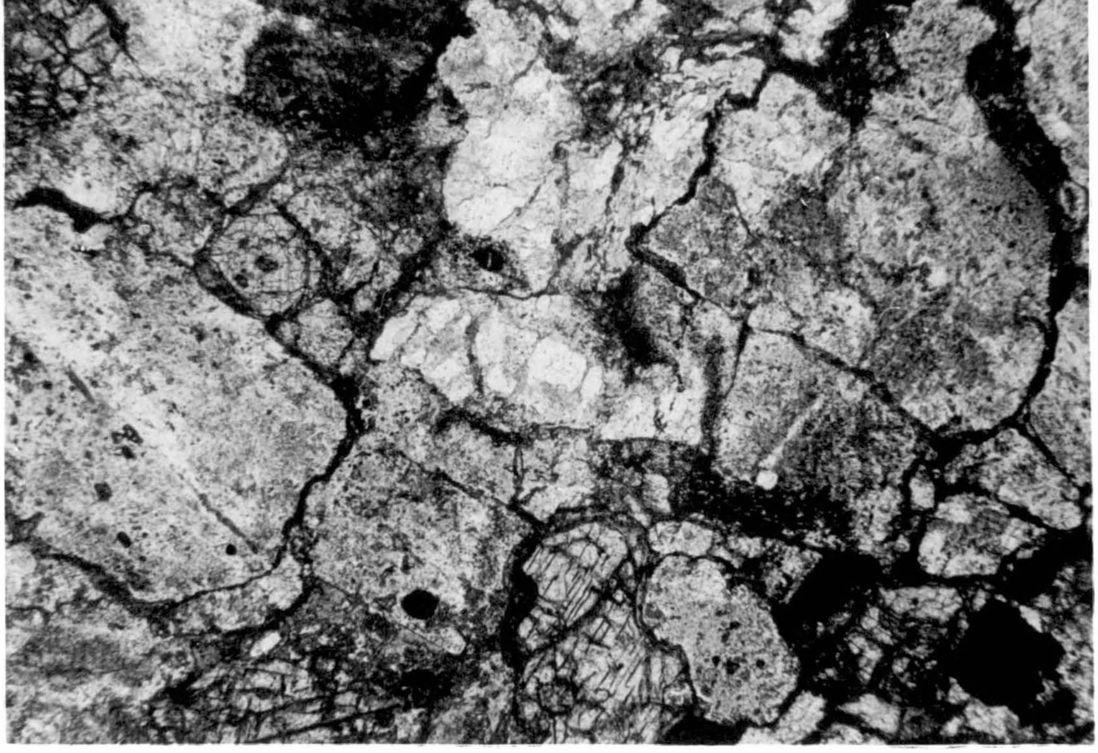
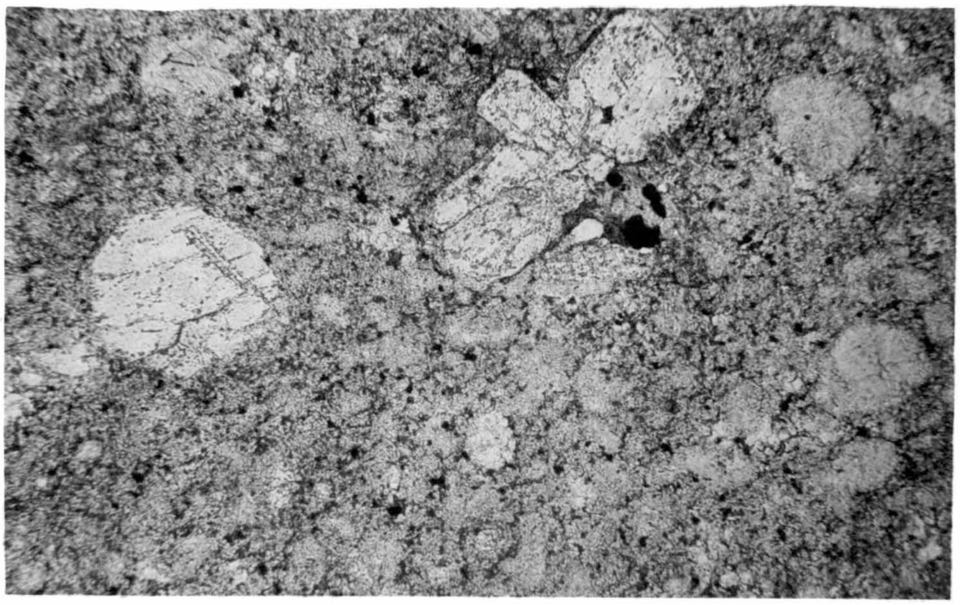


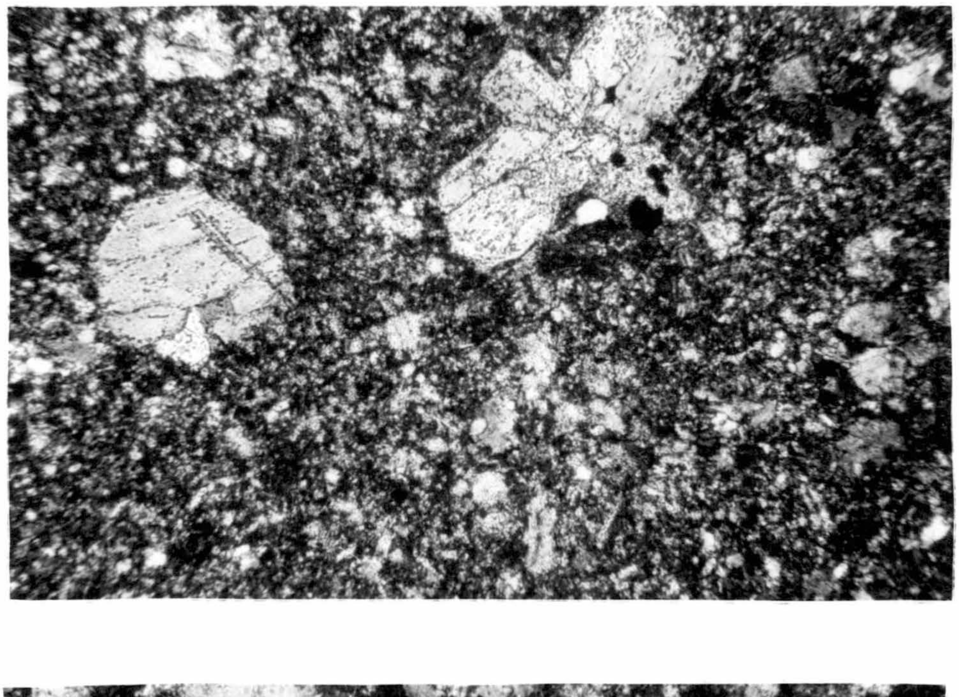
Plate 53 a) plane polarised light,

b) crossed nicols.

Albite porphyry from Whip Spur. Glomeroporphyritic albite is set in a fine-grained matrix containing a number of devitrification textures including snowflakes, spherulites and intermediate forms such as in Plate 54. Specimen 41404; magnification: x40.

Plate 54. Devitrification texture in specimen 41404. It has an extremely fine-grained structure which is intermediate between the optically radiating structure of spherulites and the optically continuous structure of snowflakes. Crossed nicols; magnification: x250.





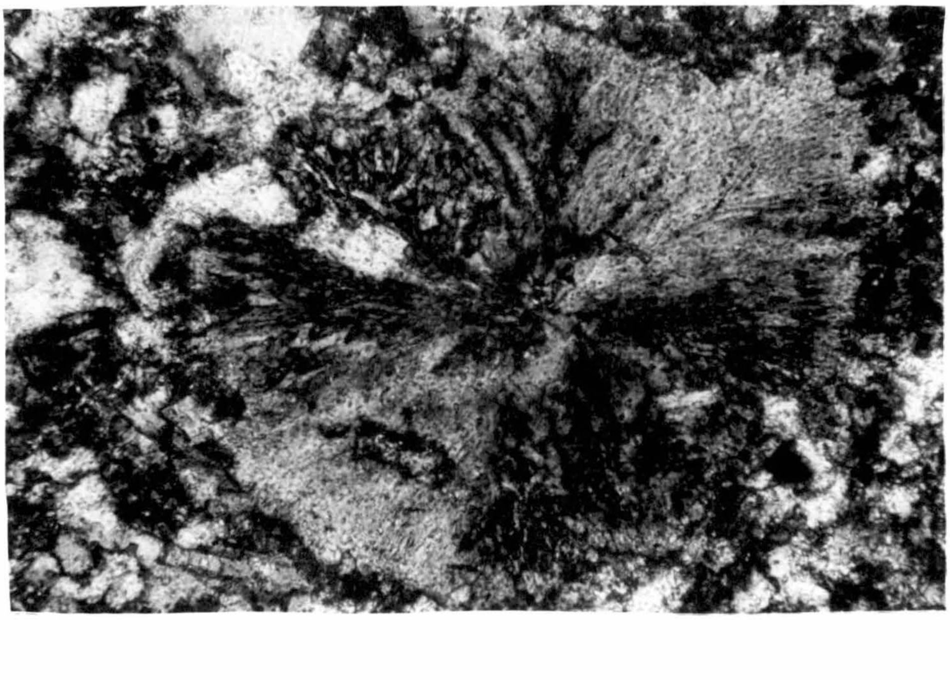
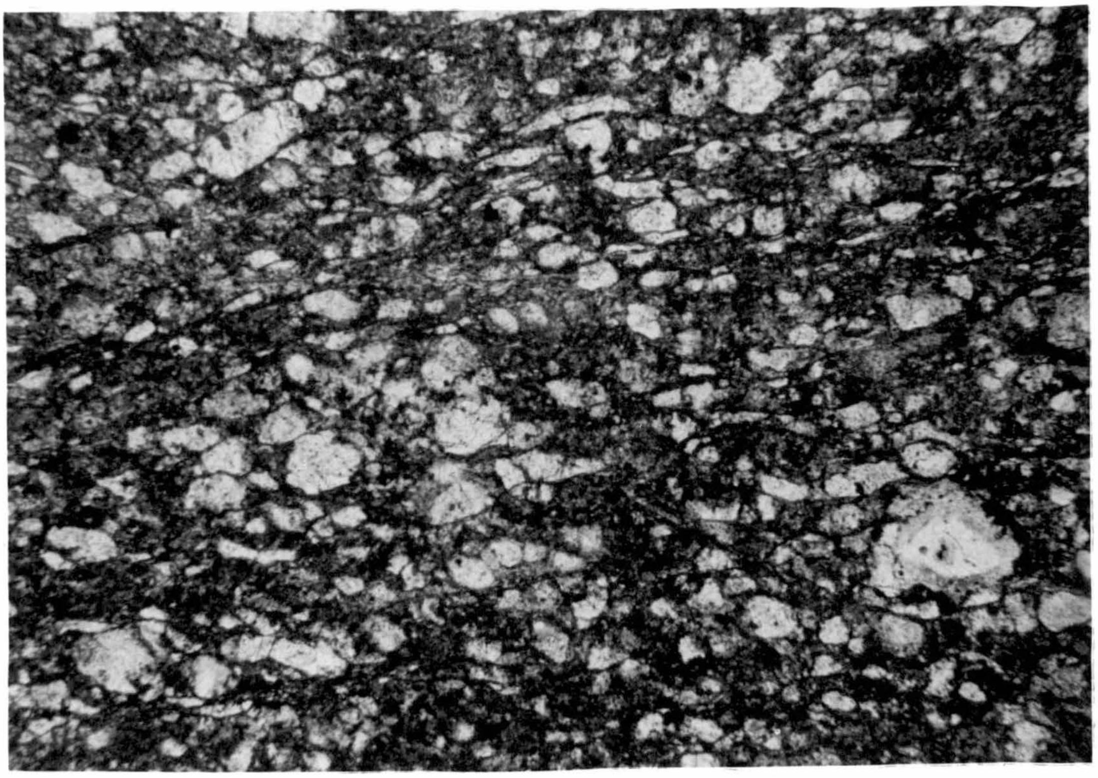


Plate 55 a) plane polarised light,

b) crossed nicols.

Crystal-vitric tuff, Lyell Highway. Fragments of quartz and devitrified glass shards are visible. Note the overgrowth on the large quartz fragment (far right) and the strong dimensional orientation. Specimen 41453; magnification: x50.



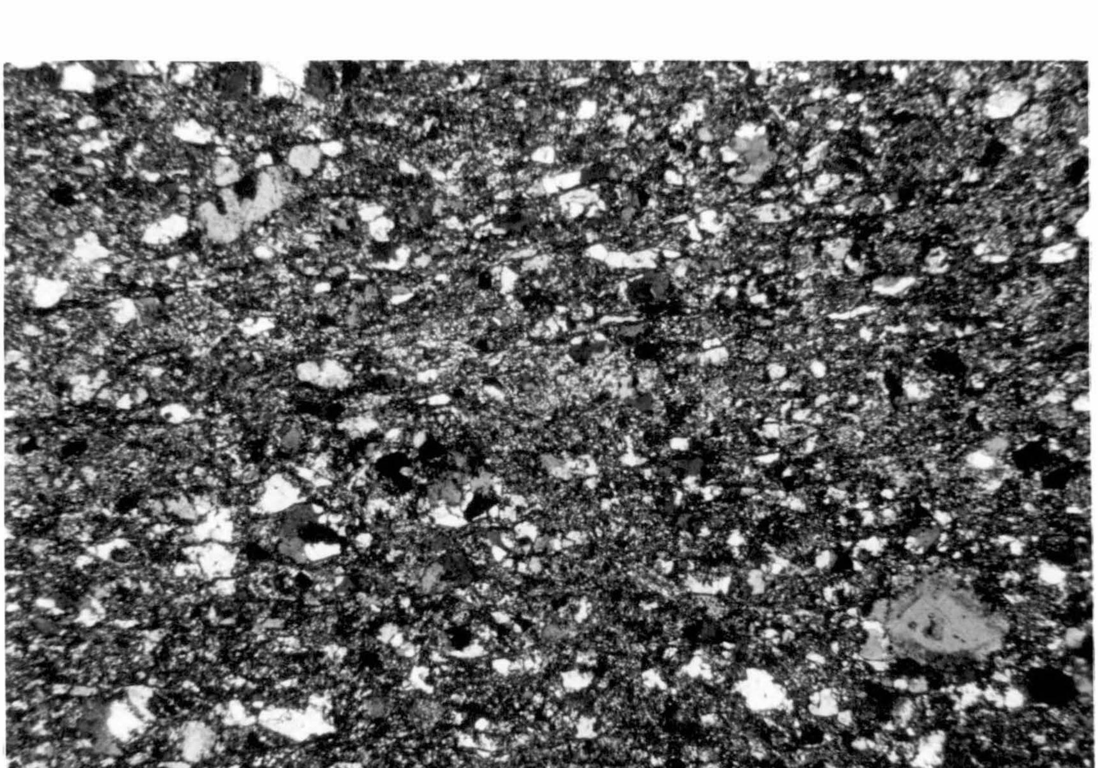
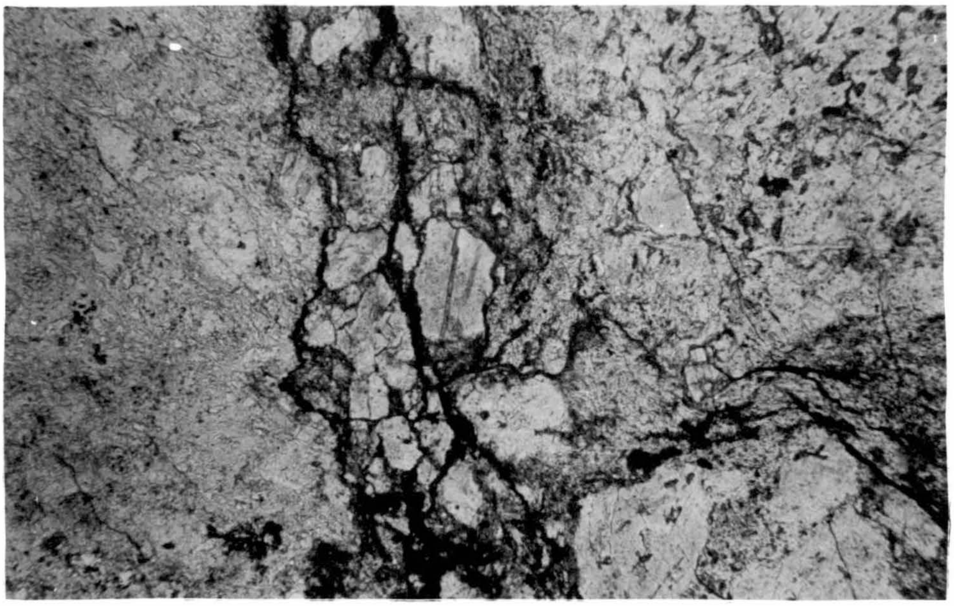


Plate 56. Albite phenocryst with original compositional zoning preserved by the accumulation of fine-grained epidote crystals. Crossed nicols. Specimen 41397; magnification: x40.

Plate 57 a) plane polarised light,

b) crossed nicols.

An accumulation of broken albite crystals between two coarse rhyolite clasts. From the base of one of the graded tuff units on Whip Spur. Specimen 41402; magnification: x40.



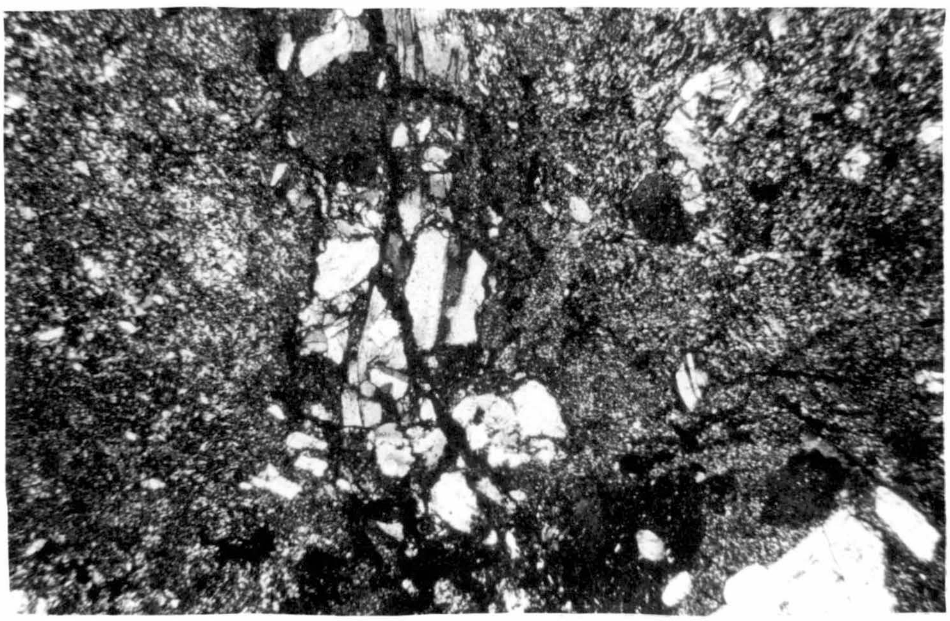
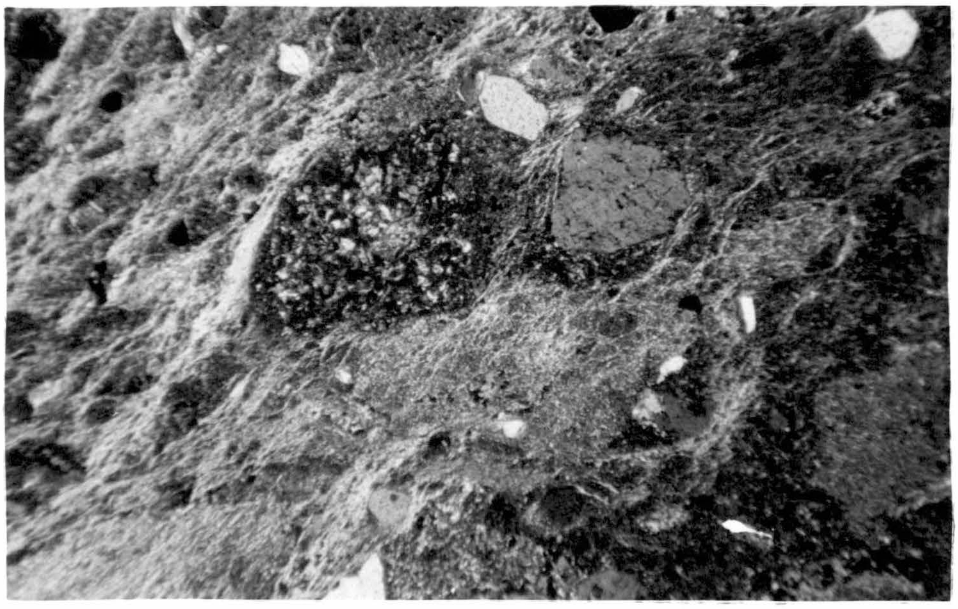


Plate 58. Crenulation cleavage kinking sericite which is aligned in the slaty cleavage of a quartz-sericite schist from East Darwin. Crossed nicols. Specimen 41250; magnification: x90.

Plate 59 a) and b).

Two cleavages in a pyroclastic of the Andrew Volcanics. The grains in the two photographs have the same orientation, but polarizer and analyzer of the microscope have been rotated to illuminate the two cleavages. Crossed nicols. Specimen 41151; magnification: x30.



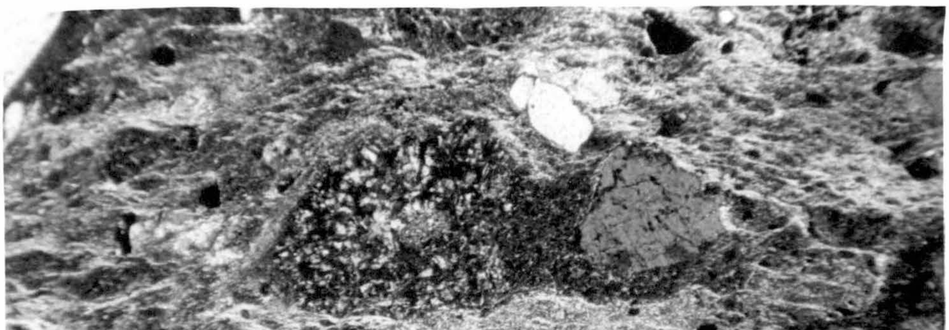
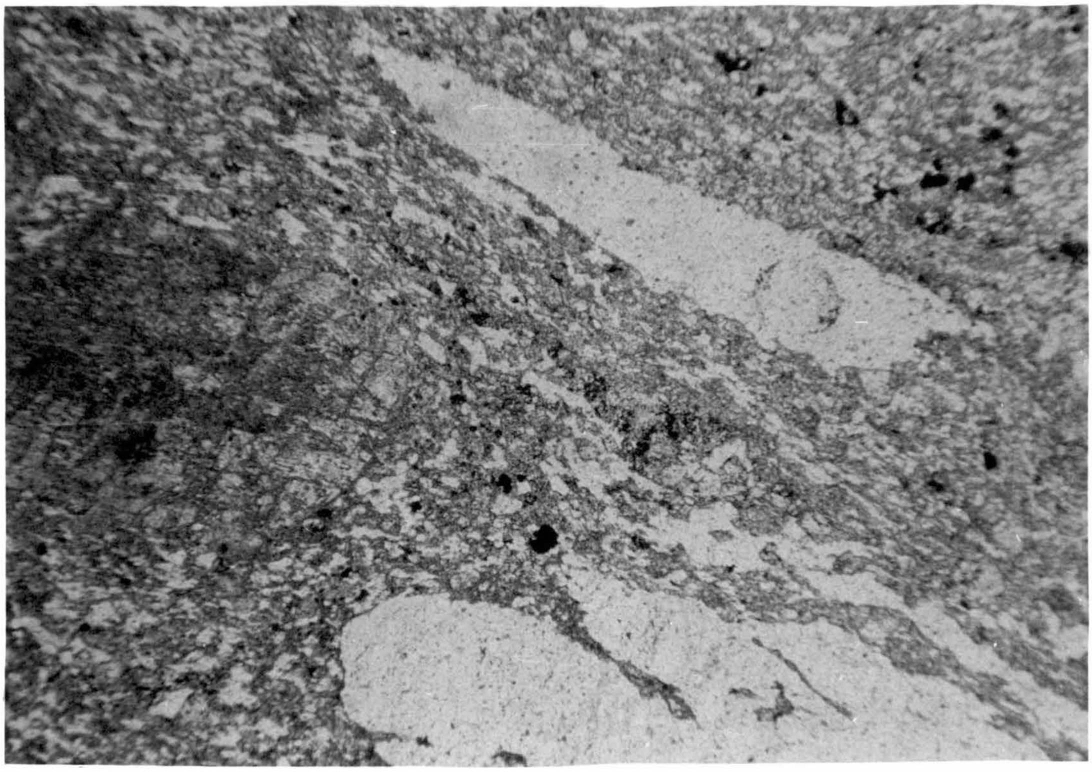


Plate 60 a) plane polarised light,

b) crossed nicols.

Extreme cataclastic deformation in specimen 41163. Quartz grains are strongly aligned and recrystallized to a fine granular mosaic. Magnification: x40.



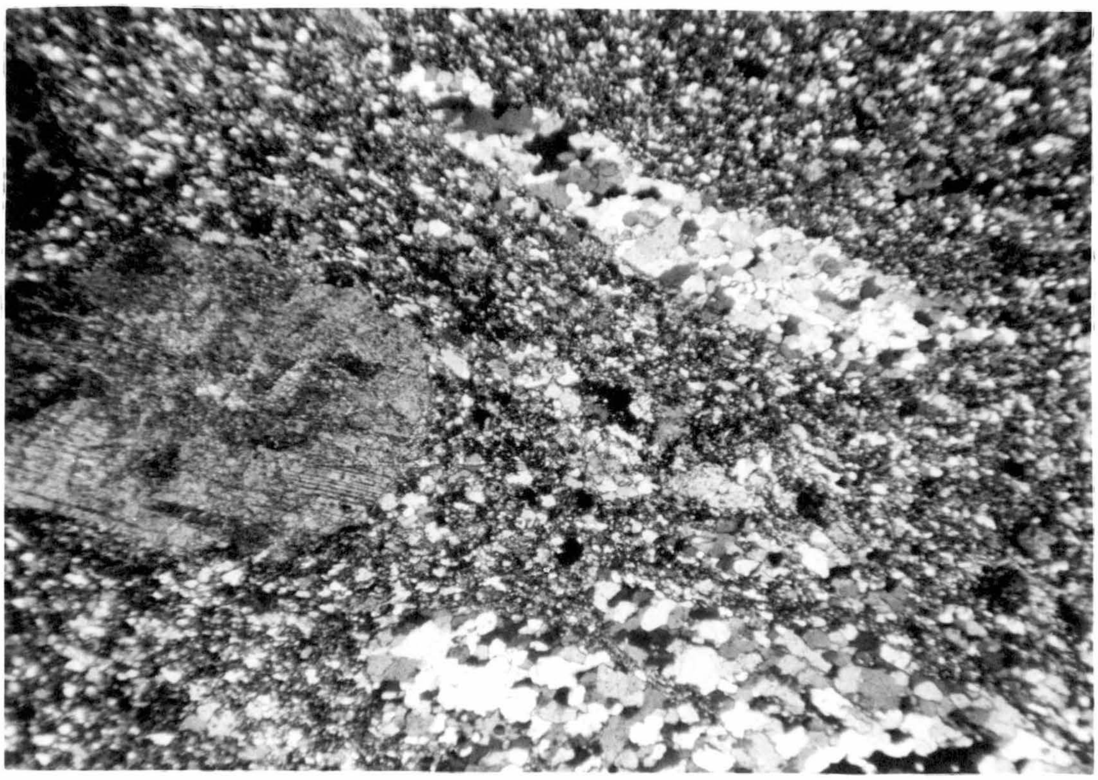
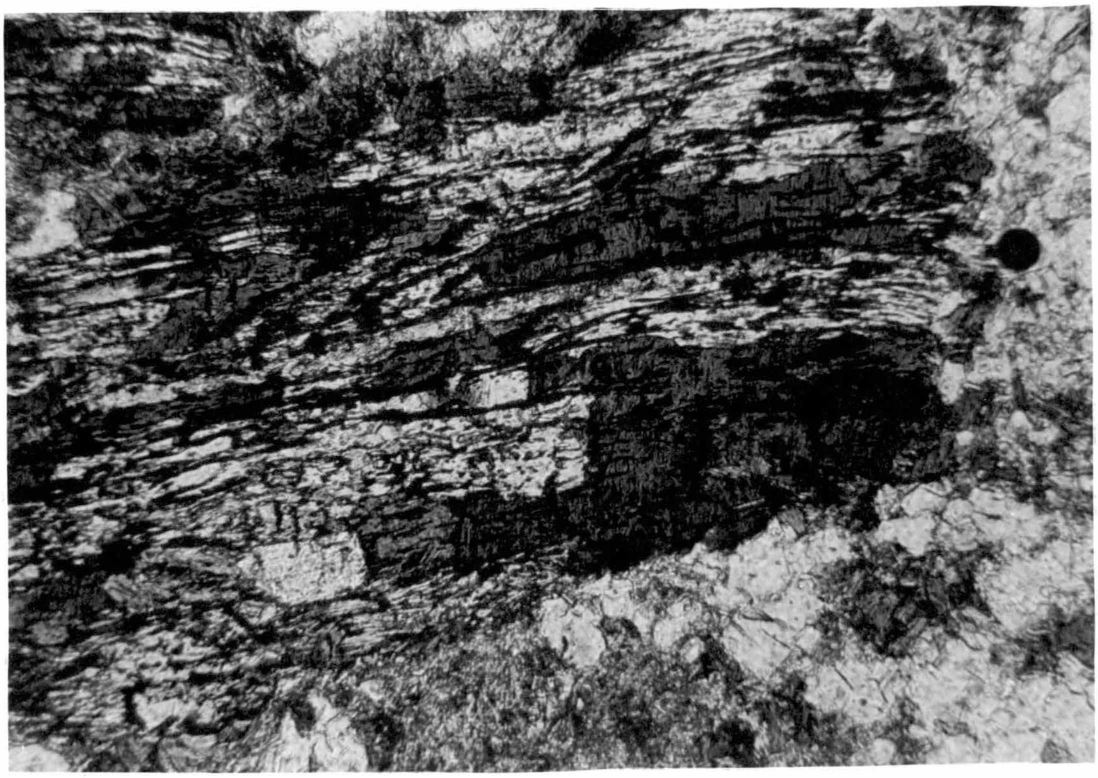


Plate 61. Green biotite (dark) with cleavage perpendicular to that in the brown biotite (light) from which it has formed by alteration. Barrel Creek Intrusion, specimen 41475, crossed nicols, magnification: x120.

Plate 62. Fine-grained green biotite replacing albite in a crystal-lithic-vitric tuff. Crossed nicols. Specimen 41481; magnification: x120.



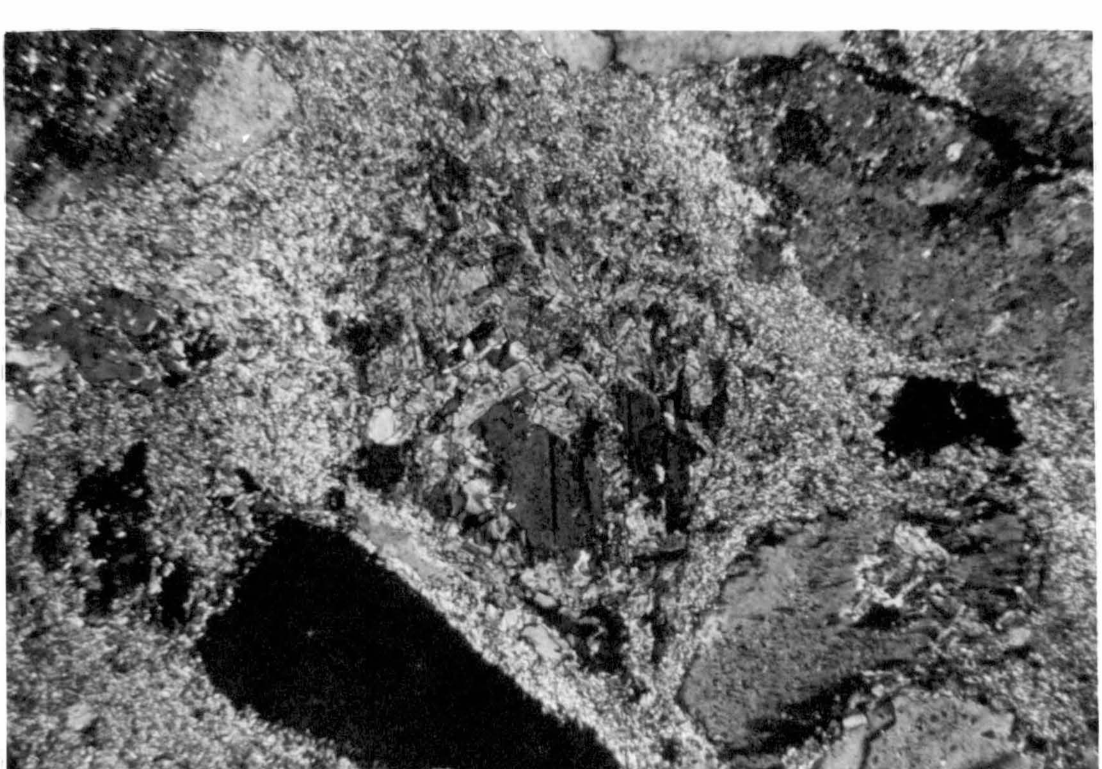
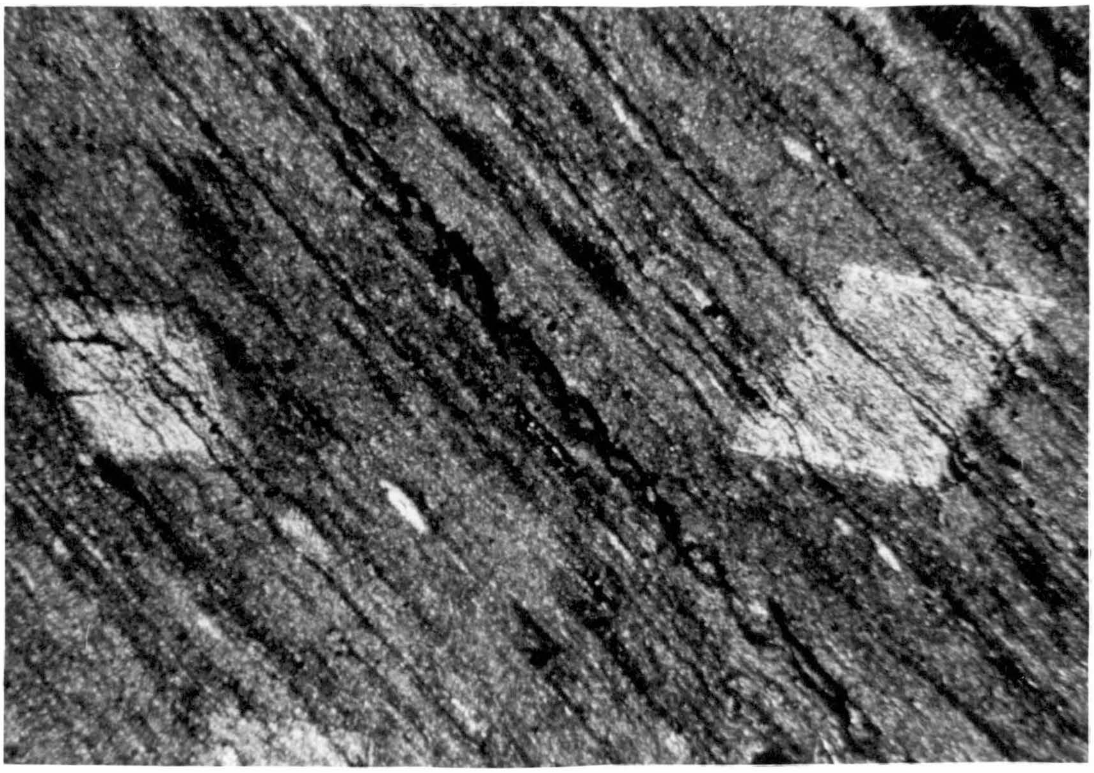


Plate 63. Euhedral dolomite rhombs in dolomitic siltstone near Sassy Creek. The dark lines are cleavage which precedes dolomite growth. Specimen 41505; magnification: x120.

Plate 64. Strongly deformed dolomitic sediment from near Sassy Creek. Bedding, slaty, and crenulation cleavage are visible in this photograph. Specimen 41503; magnification: x4.



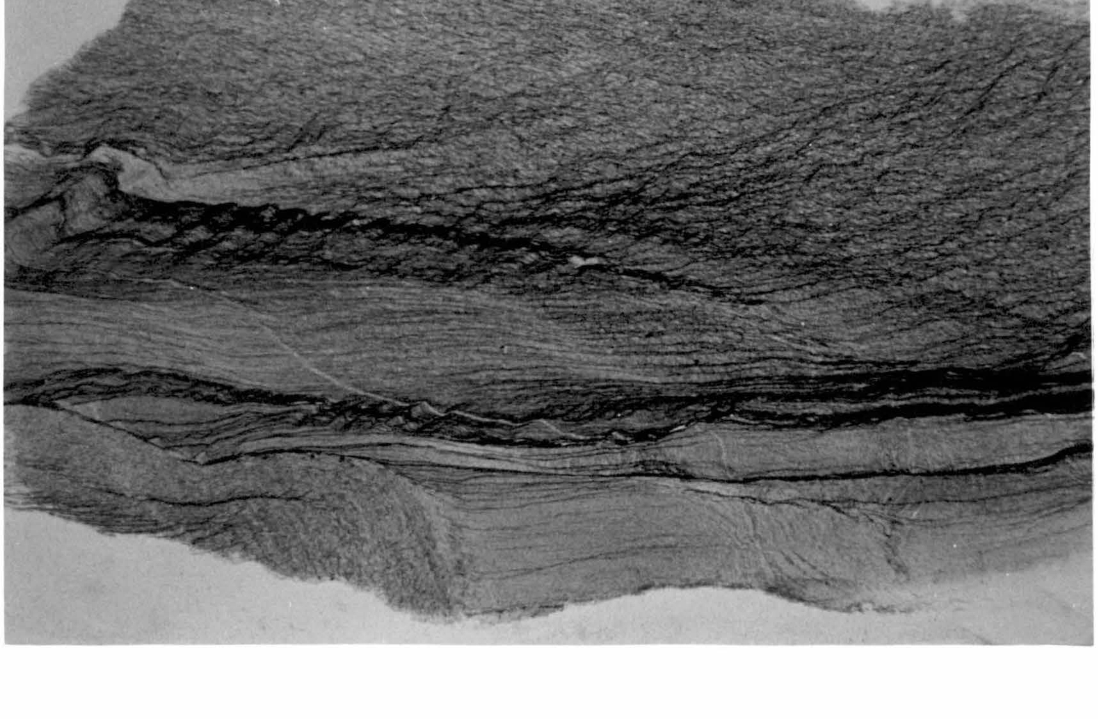
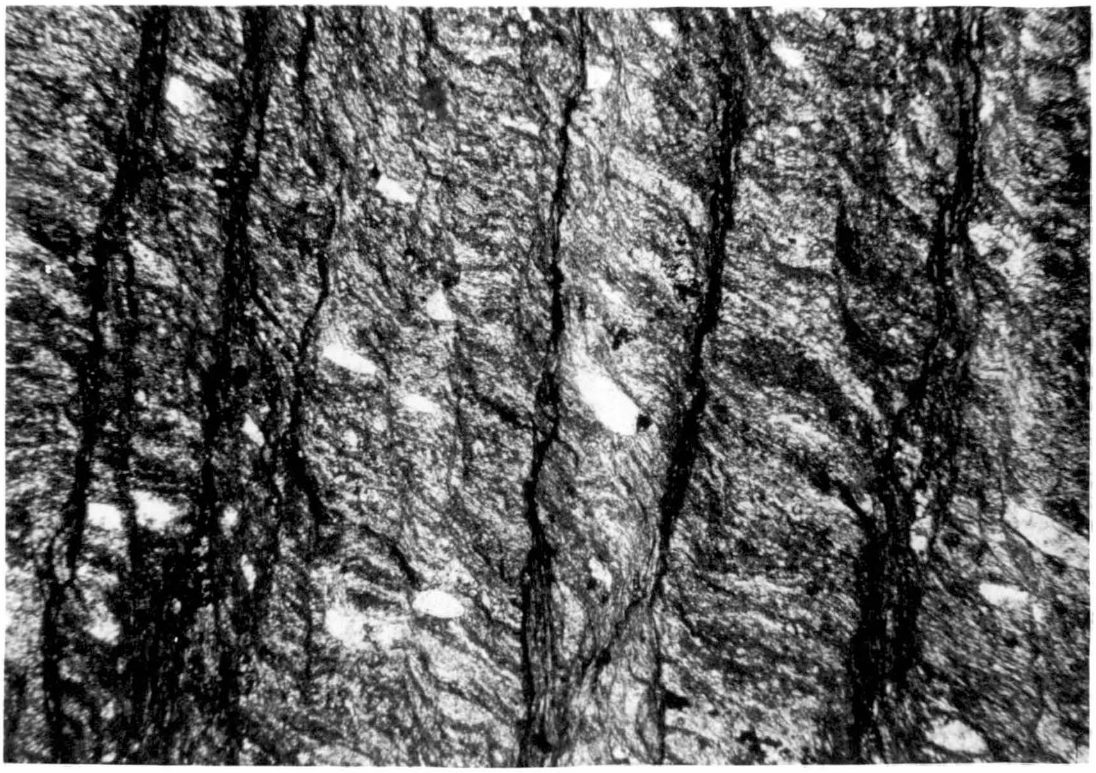


Plate 65. Crenulation cleavage cutting slaty cleavage in a tuffaceous sediment from near Sassy Creek. The clear angular grains are quartz. Specimen 41504; magnification: x50.

Plate 66. Boudinage of quartz and dolomite-rich layers between chlorite-rich layers in tuffaceous sediments from near Sassy Creek. Specimen 41502; magnification: x4



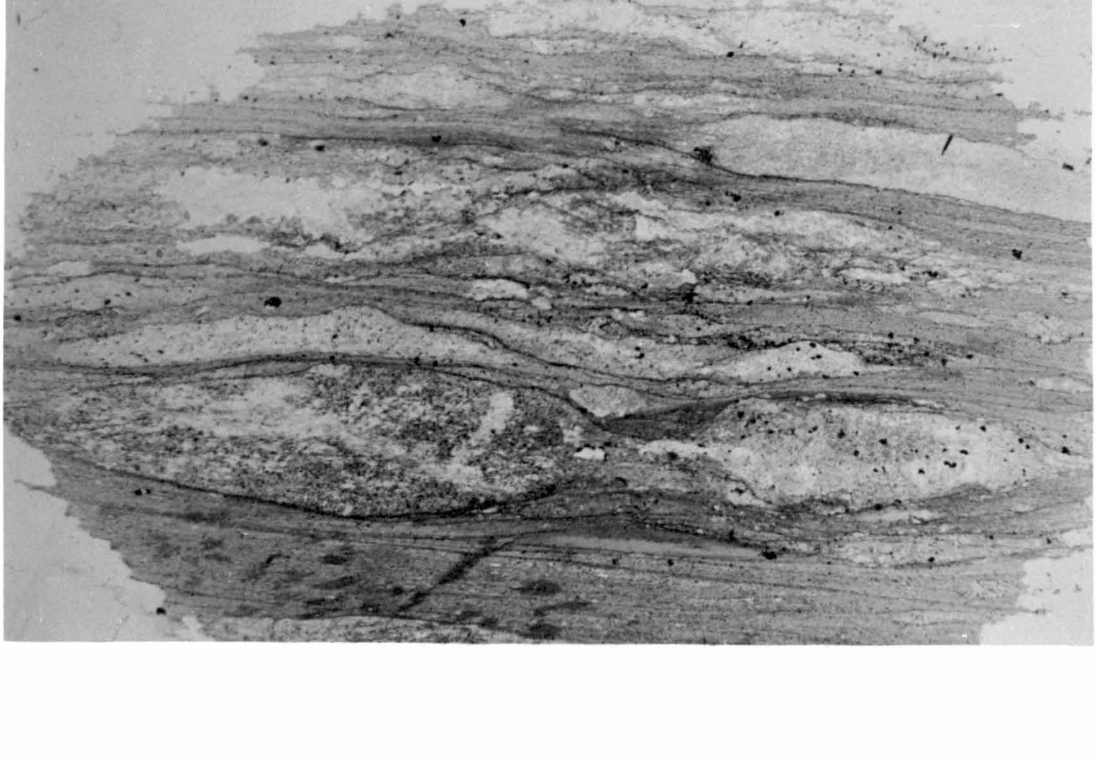
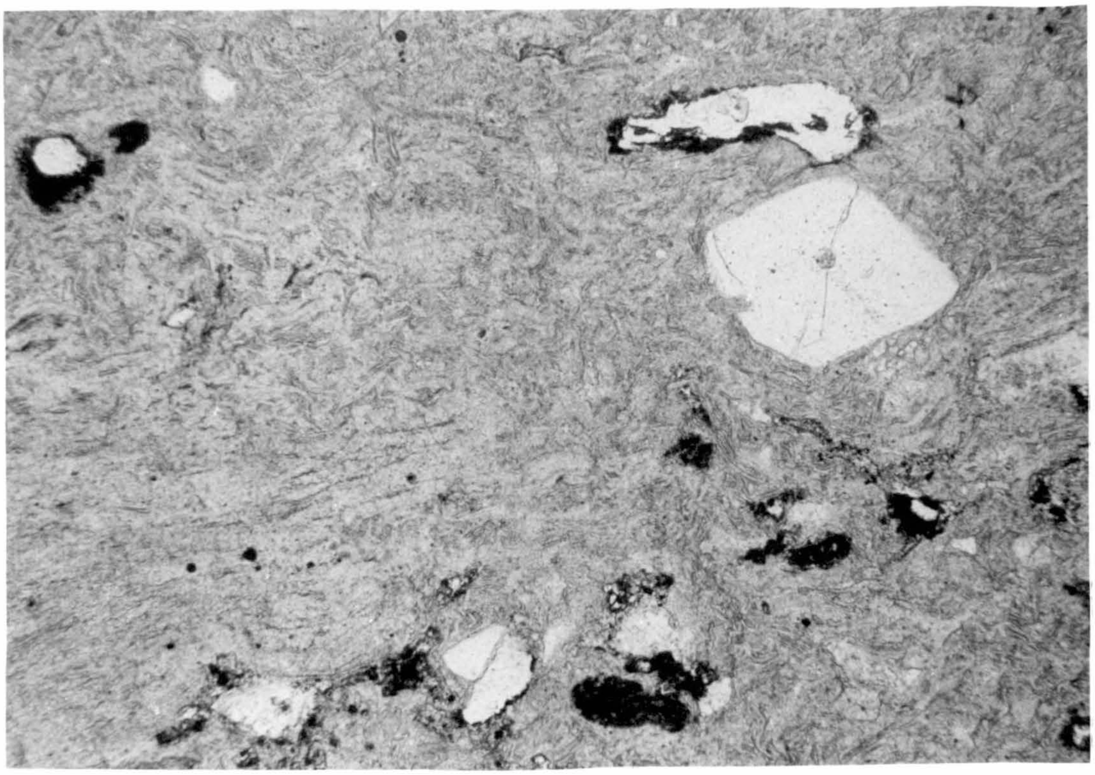


Plate 67 a) plane polarised light

b) crossed nicols.

Rhyolite ignimbrite from the Noddy Creek volcanics. Flattened and moderately welded shards form the groundmass. Specimen 41526; magnification: x50.



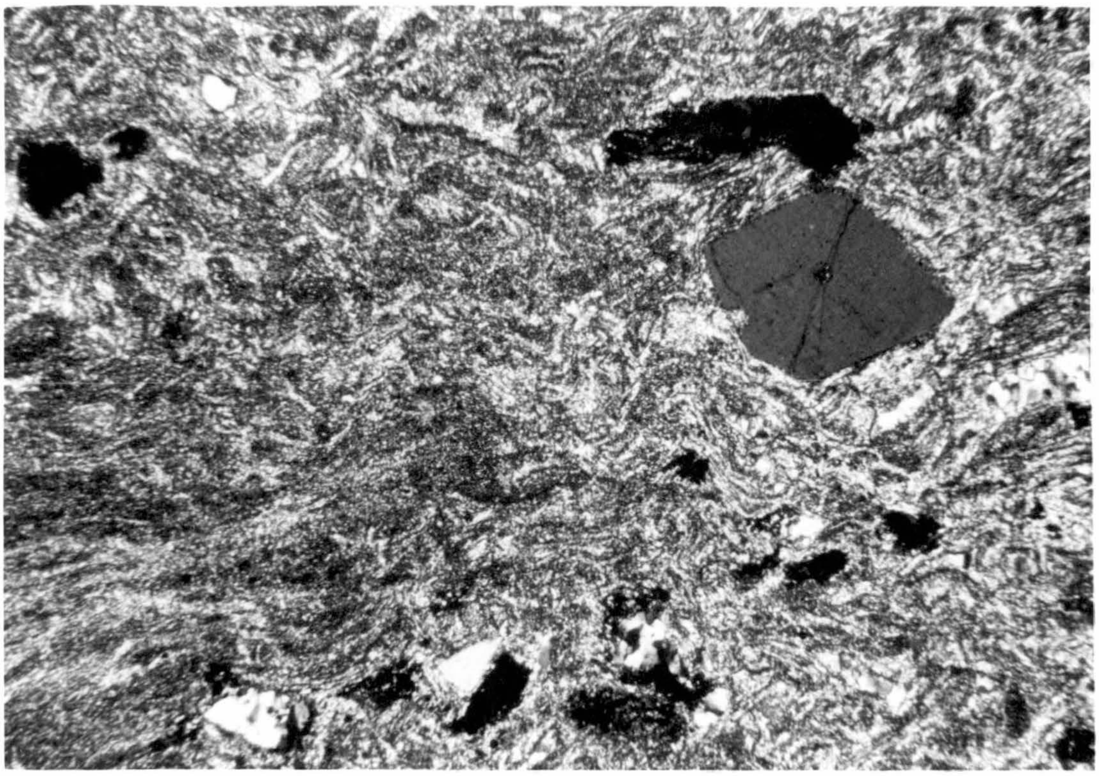
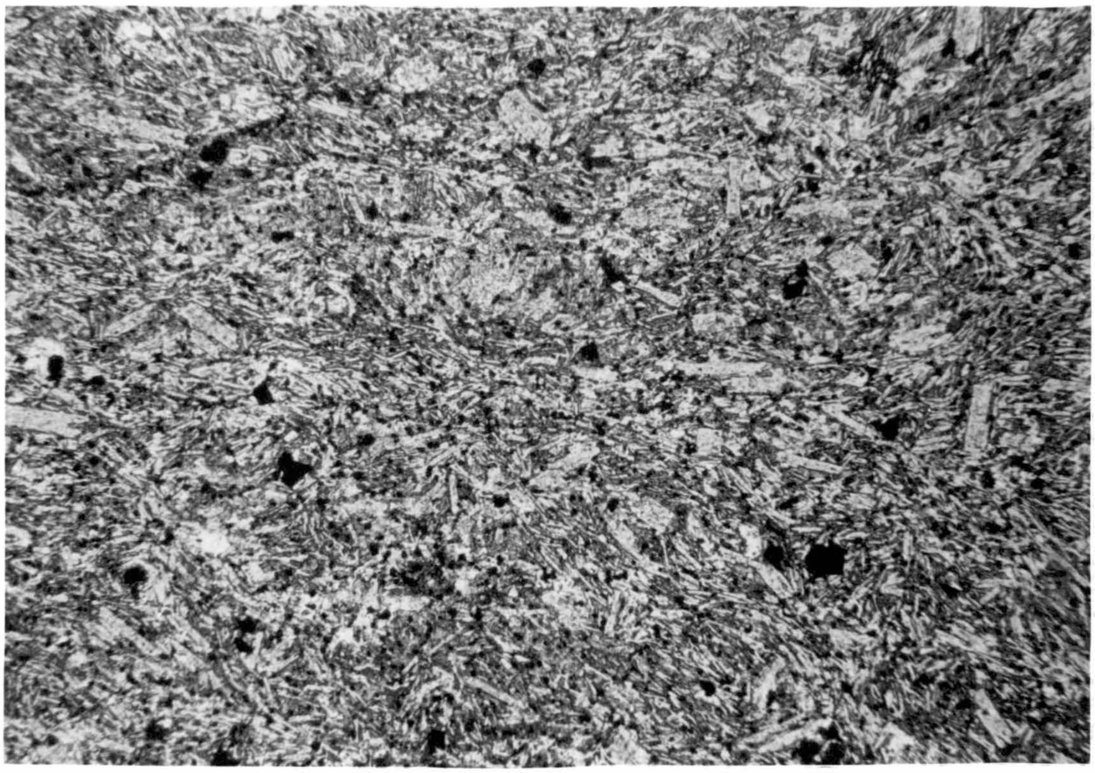


Plate 68. Fluidal basic andesite, Timbertops. Fine laths of plagioclase are aligned by flow, with a mesostasis of minor chlorite and opaques. Specimen 41524; magnification: x50.

Plate 69. Porphyritic basic andesite, Noddy Creek. Phenocrysts are dominantly augite with plagioclase. The groundmass is dominantly plagioclase and contains much granular epidote (high relief grains). Specimen 41530; magnification: x120.



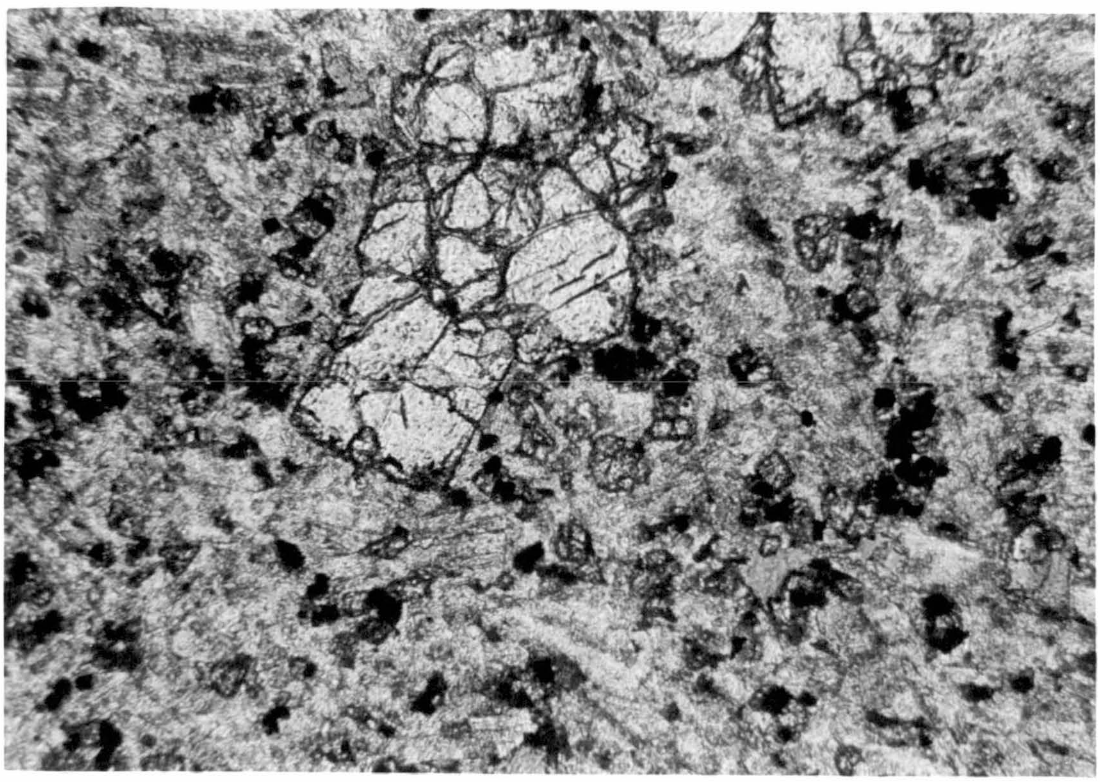
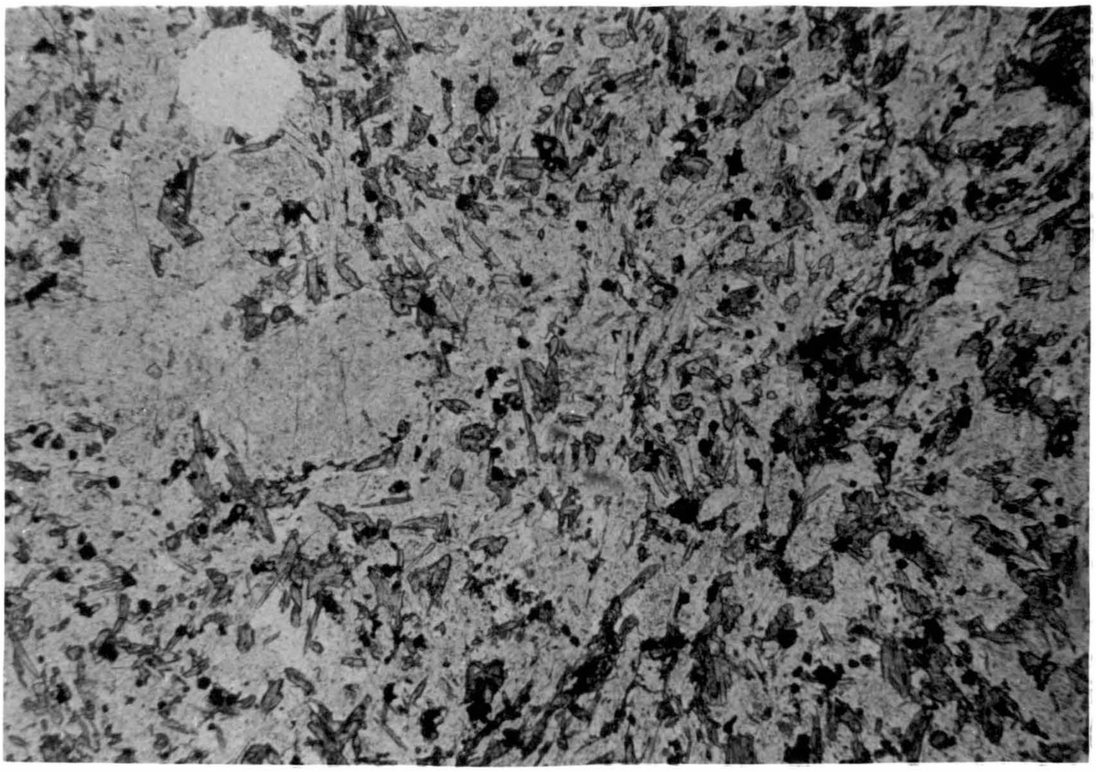


Plate 70 a) plane polarised light,

b) crossed nicols.

Microdiorite from Timbertops, consisting dominantly of albite and fine-grained green hornblende. Specimen 41517; magnification: x50.



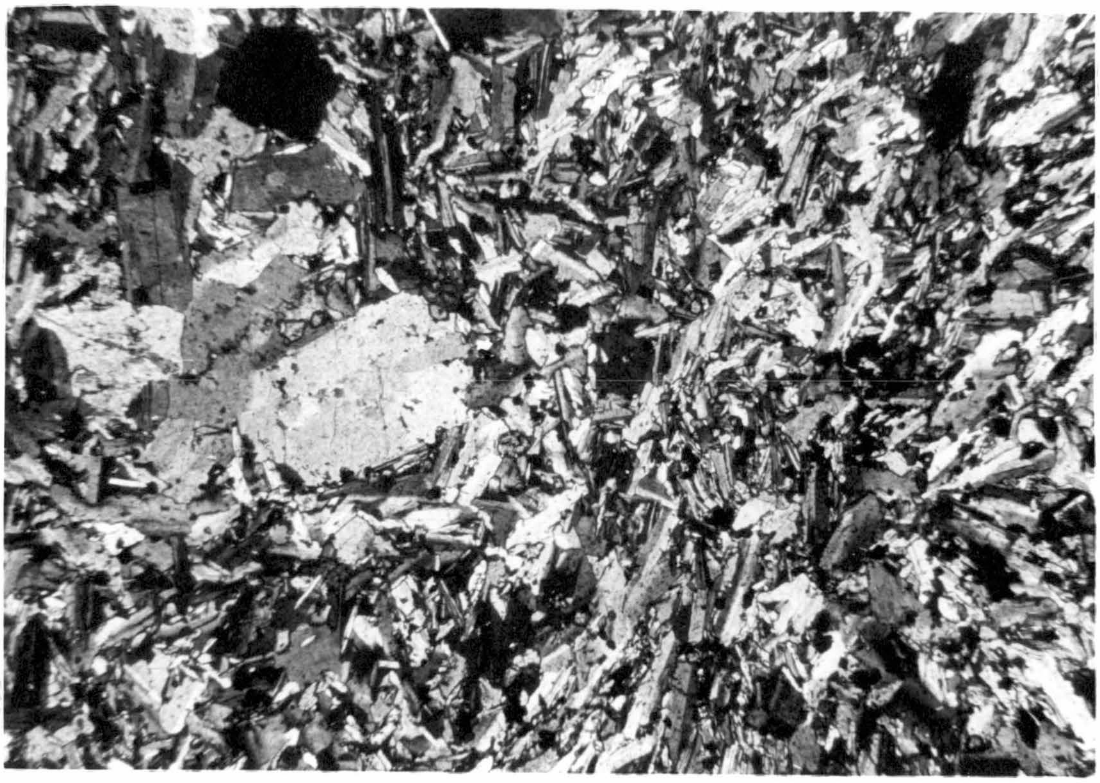
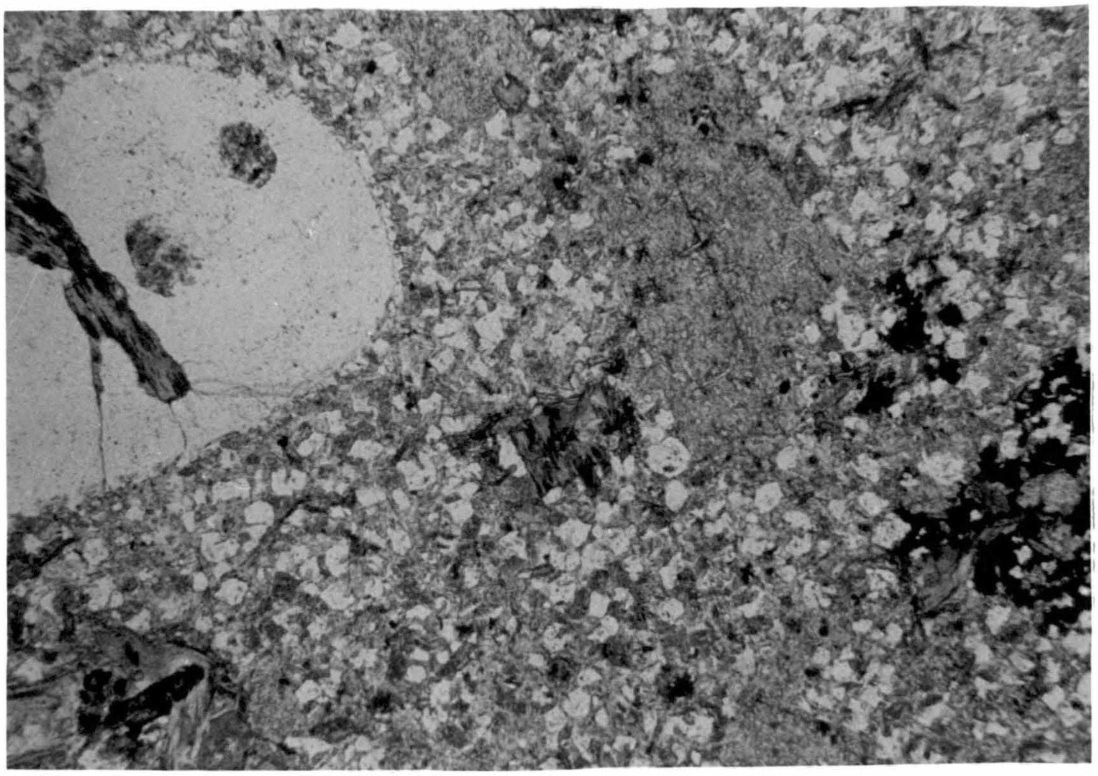


Plate 71 a) plane polarised light,

b) crossed nicols.

Intrusive quartz feldspar porphyry, Timbertops. The rounded embayed quartz and albite phenocrysts are enclosed in a fine granular quartz-feldspar groundmass with minor chlorite. Chloritised biotite phenocrysts also occur. Specimen 41514; magnification: x50.



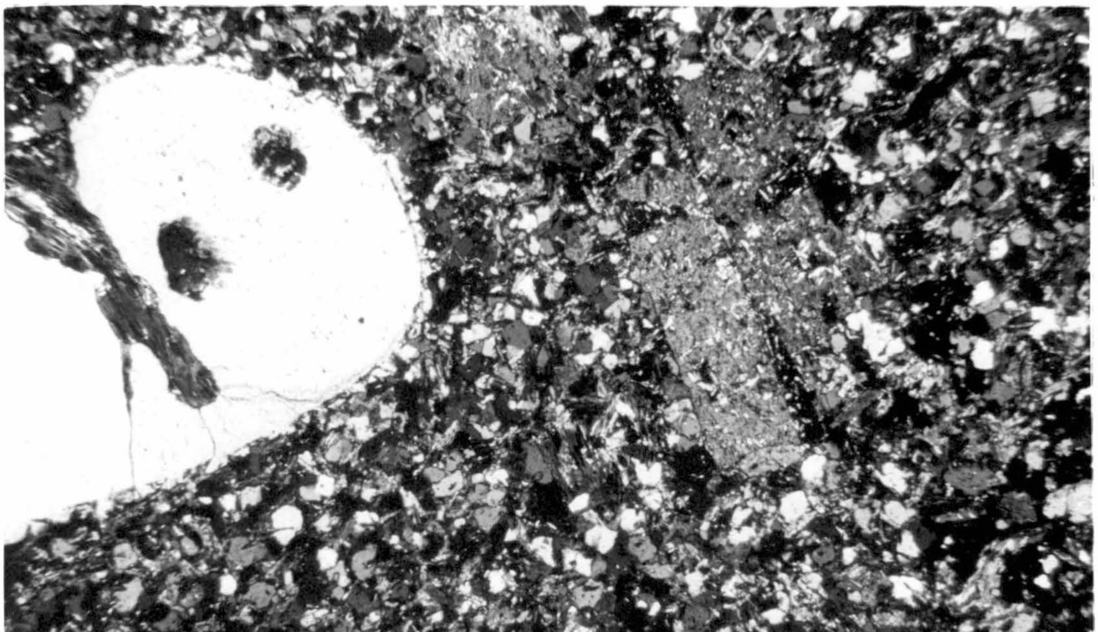


Plate 72 a) (left) plane polarised light,

b) (right) crossed nicols.

Vogesite from Noddy Creek. Consists of hornblende with chloritised biotite and minor clinopyroxene in a dominantly feldspathic groundmass. Specimen 41537; magnification: x40.

Plate 73 a) (left) plane polarised light,

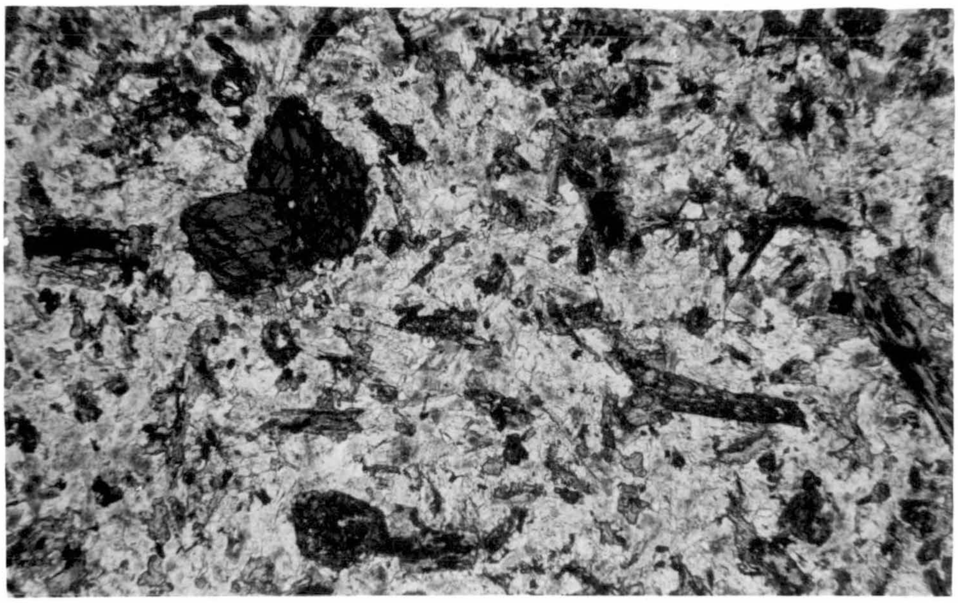
b) (right) crossed nicols.

Augite kersantite from Noddy Creek. Biotite is the dominant ferromagnesian mineral, with euhedral augite in an aphanitic groundmass containing apatite and epidote. Specimen 41539; magnification: x40.

Plate 74 a) (left) plane polarised light,

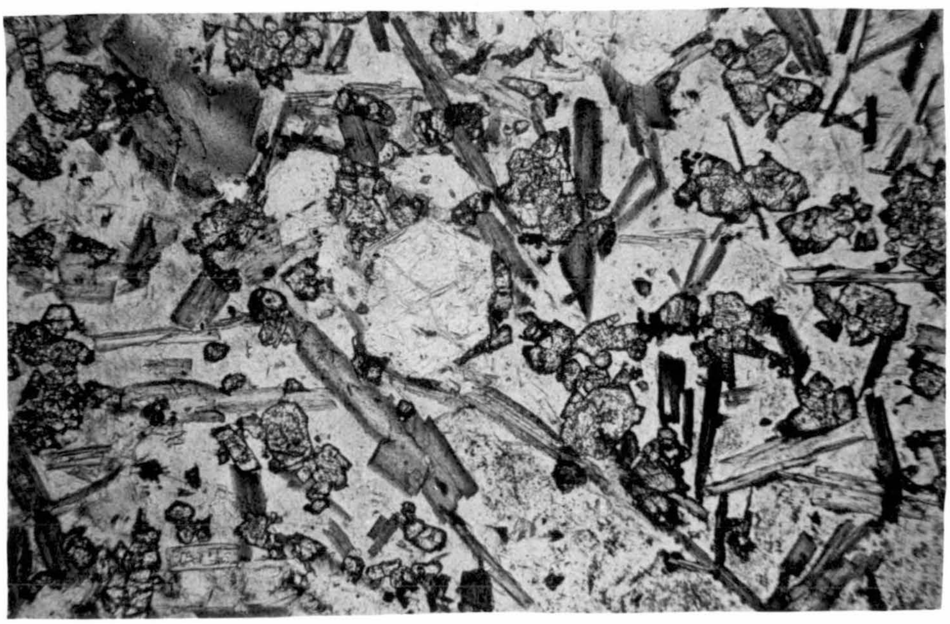
b) (right) crossed nicols.

Augite kersantite from Noddy Creek. Biotite and augite are approximately equal in abundance. The groundmass is aphanitic but contains patches of variable birefringence. Note the serpentine pseudomorph after olivine in the centre of the field. Specimen 41541; magnification: x40.



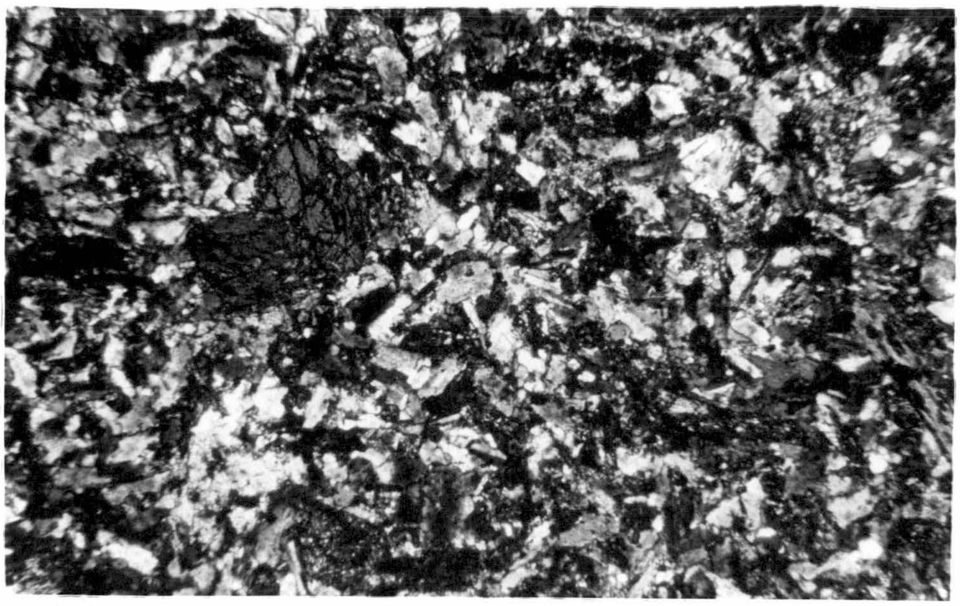
72a).

73a).

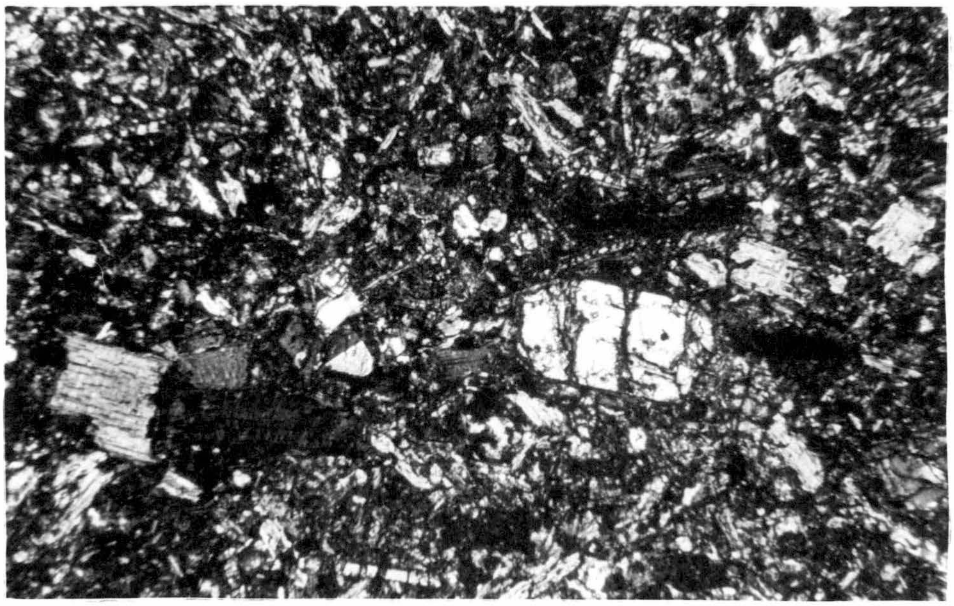


74a).

72b).



73b).



74b).

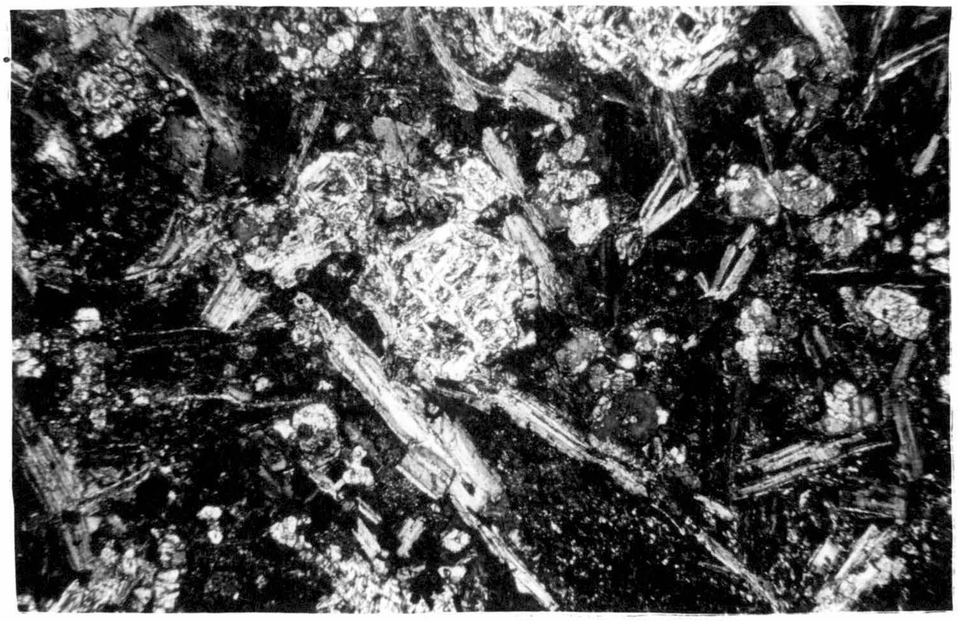


Plate 75. Xenolith in spilite from the Lucas Creek volcanics is composed of clinopyroxene. Its mineralogy and texture indicates derivation from a cumulate pyroxenite. Crossed nicols. Specimen 41570; magnification: x125.

Plate 76. View of Mount Jukes from east of Mount Huxley. The fault adjacent to Jukes Proprietary prospect is clearly visible in the volcanics (centre) and uplift of the Owen Conglomerate north (right) of the fault is also visible.

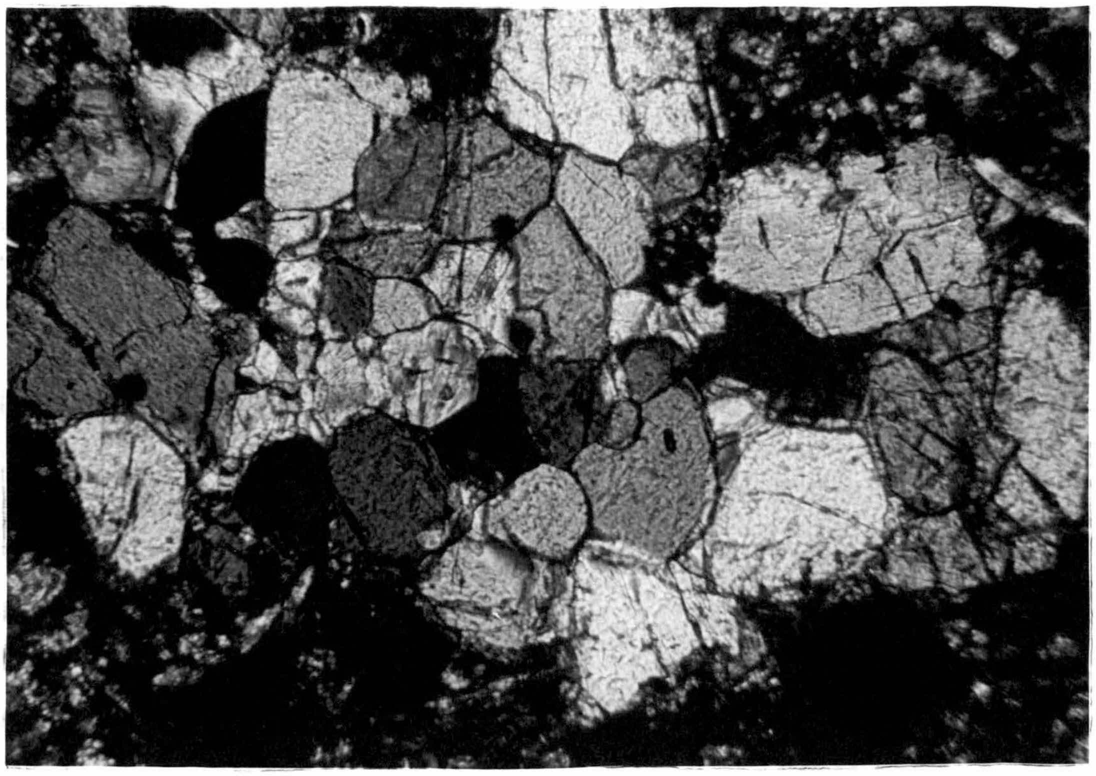


Plate 77. Saccharoidal form of barite. An individual barite crystal is surrounded by fine granular barite with areas of granular quartz (light grey). Magnification: x30.

Plate 78. Bladed form of barite - coarse crystals are largely preserved though fine granular recrystallization is apparent along crystal margins. Crossed nicols. Magnification: x4.

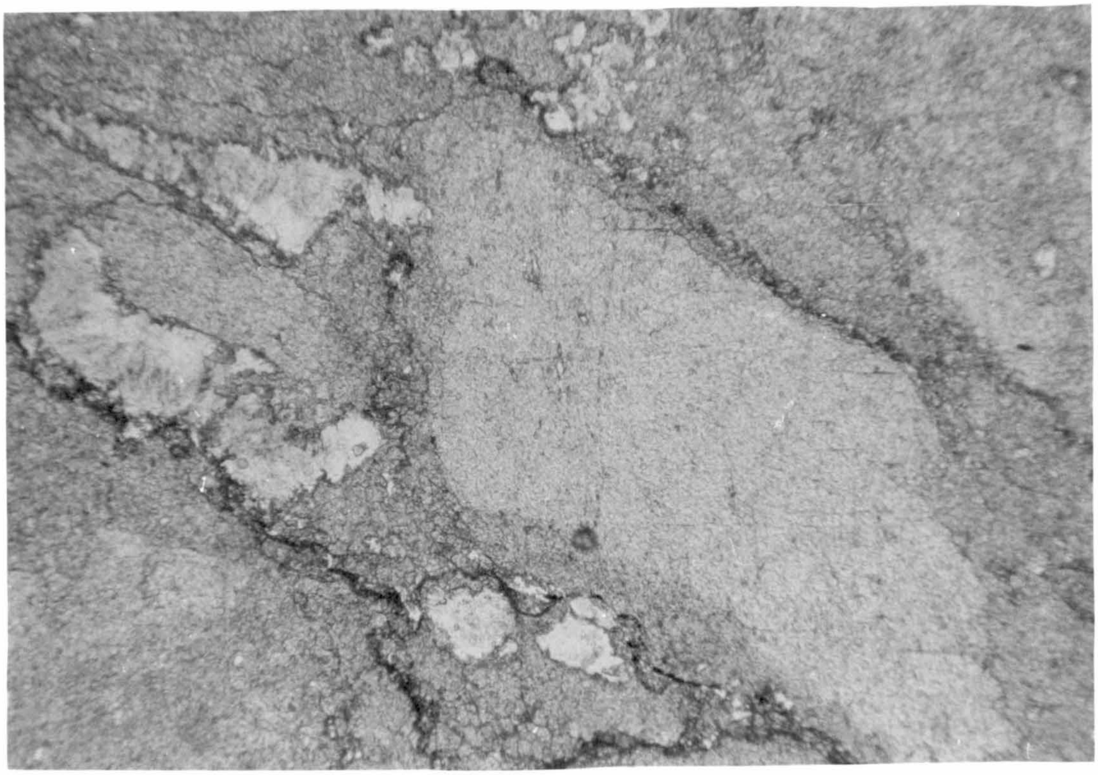


Plate 79. Colloform hematite from the margin of a thin barite vein, Taylours prospect. Reflected light, magnification: x50.

Plate 80. Pyrite crystals enclosing blebs of chalcopyrite East Darwin. Reflected light, magnification: x110.

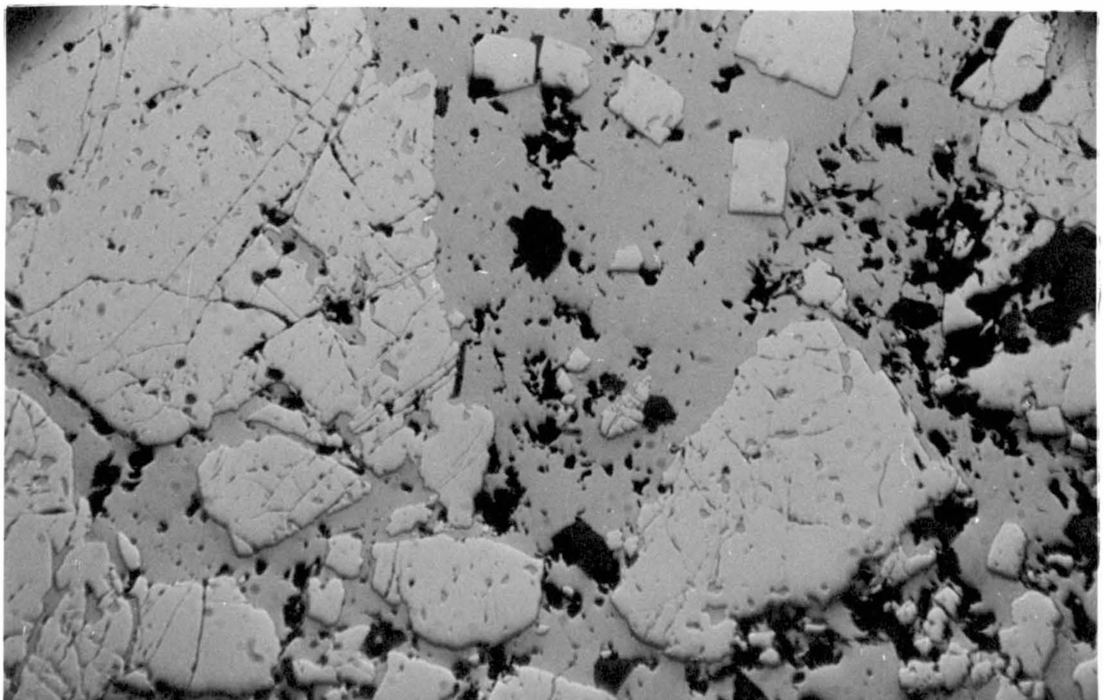


Plate 81. Crushed pyrite adjacent to a lithic fragment containing coarse subhedral crystals. Reflected light. Specimen 41299; magnification: x105.

Plate 82. Granular pyrite aggregate, East Darwin. The absence of annealing textures suggests recrystallization has been minimal. Reflected light. Specimen 41295; magnification: x50.

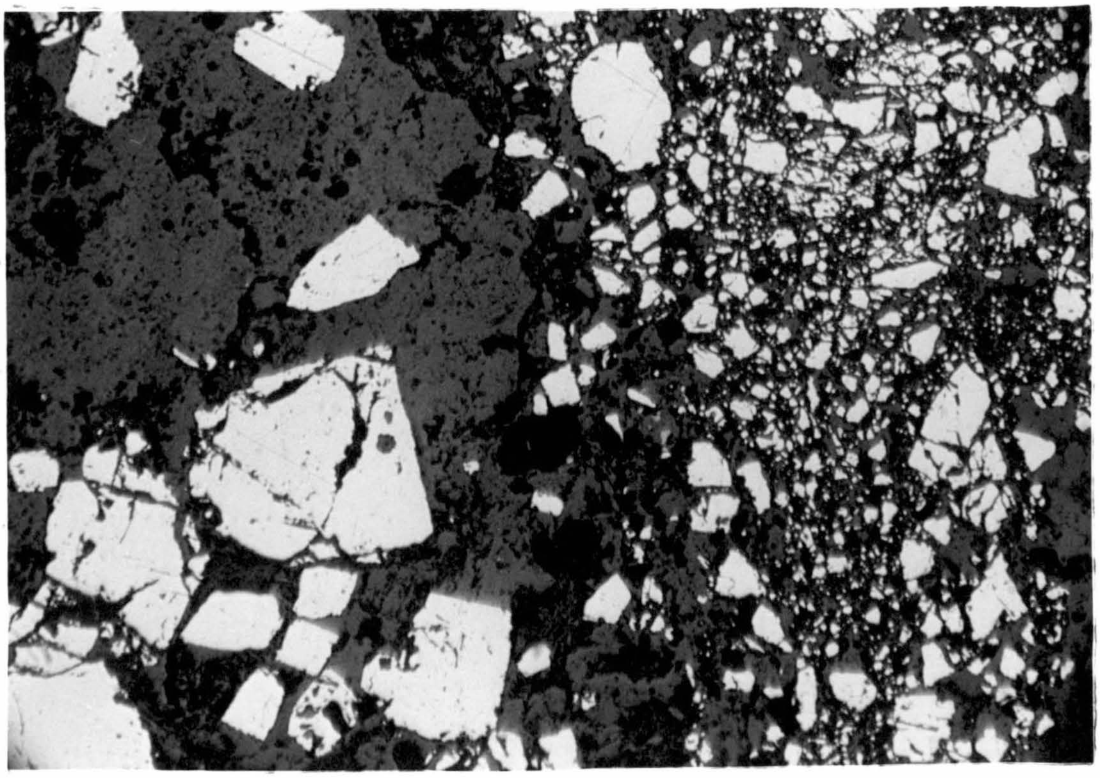
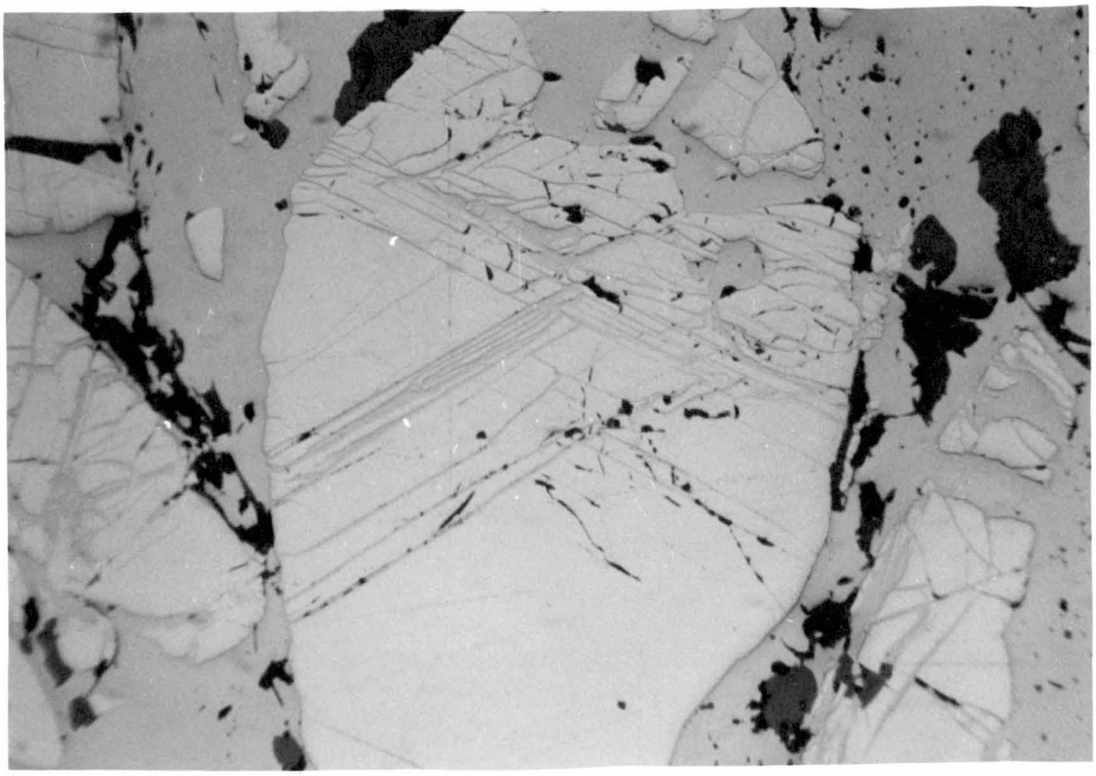


Plate 83. Cement texture in pyrite surrounded by chalcopyrite (grey). From Souters Adit, East Darwin. Reflected light. Specimen 41278; magnification: x140.

Plate 84. Vein of chalcopyrite containing a stream of crushed pyrite, and with chlorite aligned parallel to the margins. Veins of this type appear to have been forcibly injected during deformation. From Jukes Proprietary. Reflected light. Specimen 41350; magnification: x70.

Plate 81. Crushed pyrite adjacent to a lithic fragment containing coarse subhedral crystals. Reflected light. Specimen 41299; magnification: x105.

Plate 82. Granular pyrite aggregate, East Darwin. The absence of annealing textures suggests recrystallization has been minimal. Reflected light. Specimen 41295; magnification: x50.



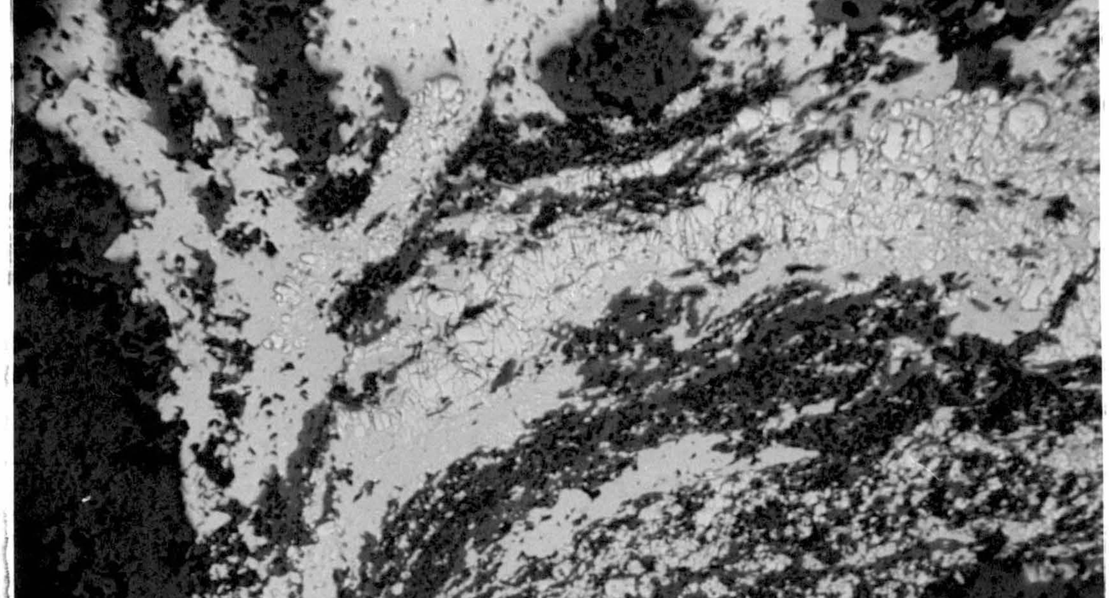
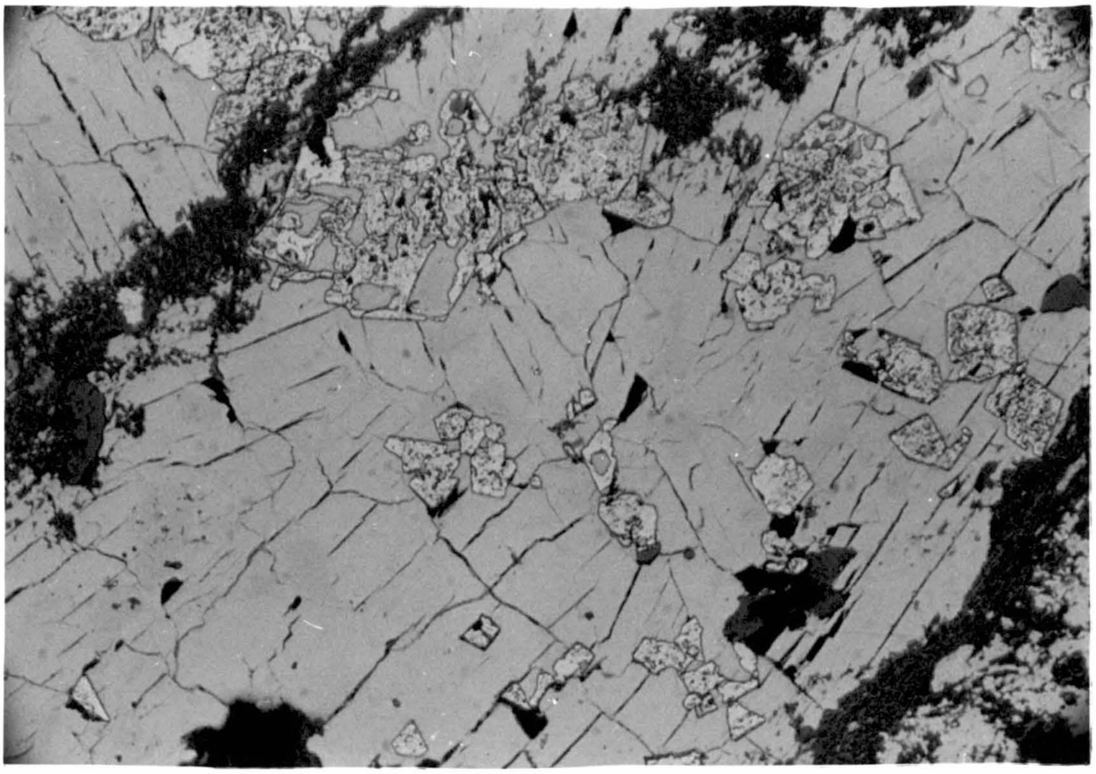


Plate 85. Skeletal crystals of martitised magnetite in a vein at Lake Jukes. The cleaved grey material is neodigenite. Reflected light. Specimen 41339; magnification: x66.

Plate 86. Martitised magnetite from a massive vein, Prince Darwin prospect. The hematite lamellae are confined to individual magnetite grains. Reflected light. Specimen 41088; magnification: x140.



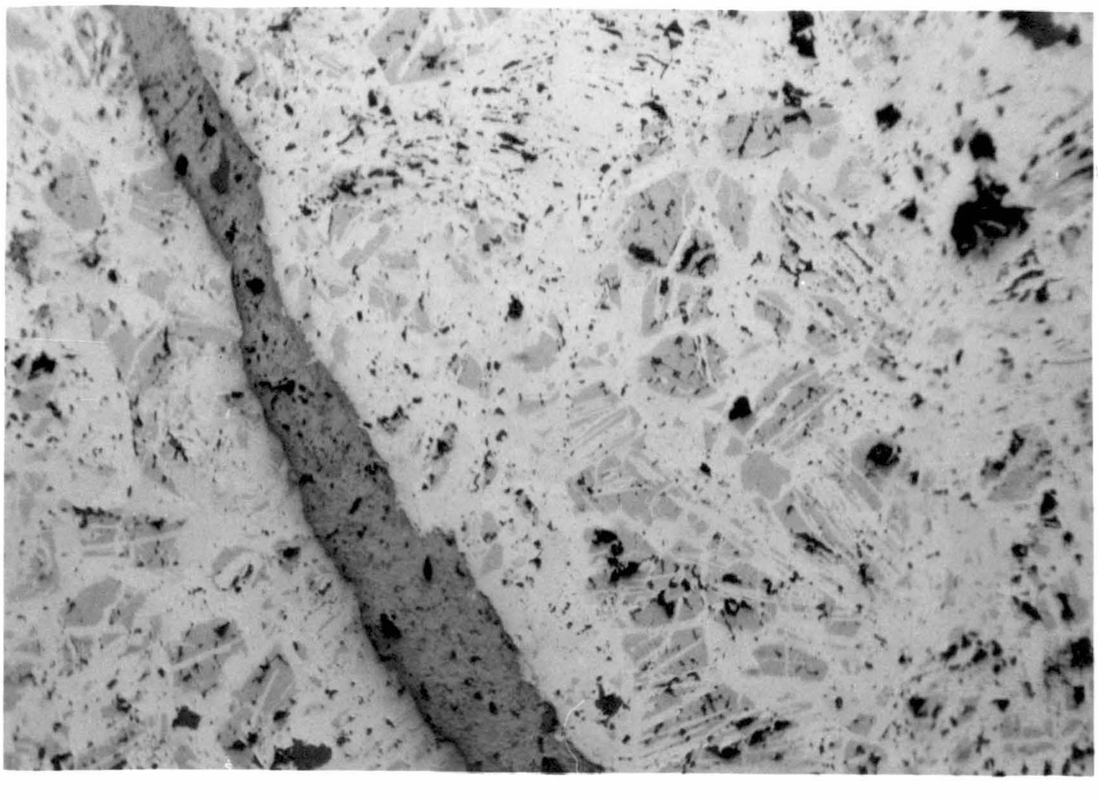


Plate 87. Fine granular magnetite (medium grey) cut by blades of specular hematite (light grey), Jukes Proprietary prospect. Reflected light. Specimen 41353; magnification: x67.